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BRIEF REPORT

Acute Effect of Eating Sweets on Alcohol Cravings in a Sample with At-Risk Drinking

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Abstract

Background Alcohol craving, or the desire to drink alcohol, has been identified as a key experience preceding alcohol use. Alcoholics Anonymous has long claimed that individuals can allay alcohol cravings by eating sweets. Empirical tests of this strategy are limited to a few preclinical studies in rats, and there is no existing experiment testing the acute effect of eating sweets on alcohol cravings in humans.

Purpose The current study sought to experimentally test the acute effect of eating sweets on alcohol cravings in a sample with at-risk drinking.

Methods After being exposed to an alcohol cue, individuals with at-risk drinking (N = 150) were randomly assigned to eat sweets (n = 60), eat calorie-equivalent bland food (n = 60), or watch a video (n = 30). Caloric amounts were manipulated. Individuals with at-risk drinking were then exposed to a second alcohol cue. Changes in alcohol cravings from after the first to after the second alcohol cue were measured via visual analog scale and heart rate.

Results There were no significant between-group differences in changes in alcohol cravings. Caloric amounts did not modify effects.

Conclusions Experimental findings did not provide evidence to support the clinical lore that eating sweets can reduce alcohol cravings, albeit only acutely and for those with at-risk drinking. Other empirically supported strategies for managing alcohol cravings (e.g., pharmacotherapies, mindfulness) could instead be promoted.

Keywords: Alcoholics Anonymous • Alcohol cravings • At-risk drinking • Sweets

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Introduction

Alcohol craving, or the desire to drink alcohol [1], has been identified as a key experience preceding increased alcohol use. For example, in a sample of 1,370 adults in treatment for alcohol use, elevated alcohol cravings were prospectively associated with increased alcohol use [2]. Moreover, elevated alcohol cravings are robustly associated with relapse among adults attempting alcohol abstinence [3]. Interventionists who aim to decrease alcohol use, in result, have largely focused on developing strategies for managing alcohol cravings [4, 5].

Alcoholics Anonymous has long claimed that individuals can allay alcohol cravings by eating sweets [6]. For instance, the community published that, "…based on our own personal experience, rather than on scientific reports…we can only pass on the word that thousands of us—even many who said they had never liked sweets—have found that eating or drinking something sweet allays the urge to drink [6]." The public has broadly shared this claim as shown in articles on the Internet [7]. In other words, the belief that eating sweets is an effective strategy for managing alcohol cravings has grown widely despite lack of scientific support.

Indeed, empirical tests of the claim that sweets reduce alcohol cravings so far are limited to a few preclinical studies in rats. A first study found that rats that drank a small amount of a sucrose solution (<1.00% [w/v]) drank *more* alcohol later that day [8]. As the amount became larger (>1.25% [w/v]), however, rats drank less alcohol [8]. A second study found that, after drinking a saccharin solution (0.1% [w/v]) for 5 days, rats with genetically determined alcohol preference drank less alcohol for 10 days [9]. In sum, a few preclinical findings suggest eating sweets may reduce alcohol intake but effects are dependent on modifying factors such as dose.

Translational work in humans is sorely needed to support any clinical application. To begin filling this gap in the literature, the current study sought to experimentally

test the acute effect of eating sweets on alcohol cravings in a human sample with at-risk drinking. Furthermore, the current study manipulated the caloric amounts of sweets because of the findings from rat research [8]. The first preregistered hypothesis was that individuals who ate sweets would have dampened alcohol cravings compared to control conditions. The second preregistered hypothesis was that a greater caloric amount of sweets would lead to a greater dampening of alcohol cravings. The current research included preregistered tests for individual difference effects; all information regarding these tests is presented in Supplementary Materials.

Methods

Participants

A sample of 150 individuals with at-risk drinking was recruited from Los Angeles, CA. At-risk drinking was defined as scoring 8–15 on the Alcohol Use Disorder Identification Test [10]. A sample with at-risk drinking was recruited so that participants would be responsive to alcohol cues in the laboratory but also homogeneous in regards to their drinking behavior [1]. Table 1 provides sample demographics, including number of drinking days, mean standard drinks, and mean Blood Alcohol Concentration (BAC) in past 30 days. The sample size was selected based on an *a priori* power analysis conducted in G*Power Version 3.1.7 [11] with: power >.95, α = .05, two time points, expected r = .50 between repeated measurements (default), and expected Cohen's d = .40 (based off drug cue reactivity literature) [12]. With the observed repeated measurement correlations, all analyses were suitably powered at >.83 for even a small effect size (see Supplementary Table A1).

Inclusion criteria were: (a) age 21–55, (b) fluency in English, and (c) score of 8–15 on the Alcohol Use Disorder Identification Test. Exclusion criteria were: (a) age >55, (b) score <8 or >15 on the Alcohol Use Disorder Identification Test, indicating either no-risk drinking (<8) or high likelihood of alcohol use disorder (>15), (c) self-reported (yes/no) treatment for alcohol use or a history of treatment/treatment seeking in last 30 days, (d) self-reported (yes/no) current (last 12 months) diagnosis of a substance use disorder for psychoactive substances other than nicotine, (e) self-reported (yes/no) current diagnosis of an eating disorder, (f) current diagnosis of food addiction based on the Yale Food Addiction Scale [13], (g) self-reported (yes/no) strict diet that would prevent sweets intake, and (h) self-reported (yes/no) food allergies to food options in study. Inclusion/exclusion criteria were assessed through an online screening questionnaire with distractor questions. There also was over-recruitment for Asian participants to increase genetic representativeness for individual difference tests (see Supplementary Materials).

Table 1. Demographics of study sample

	Mean	*SD*
	%	
Age	25.15	7.39
Sex (% male)	53.3%	
Race/ethnicity		
Caucasian	34.0%	
Asian American	32.7%	
Hispanic/Latinx	16.7%	
African American	7.3%	
Multiracial/Other	7.3%	
Arabic/Middle Eastern	2.0%	
Subjective socioeconomic status[a]		
First rung (Lowest)	0.0%	
Second rung	1.3%	
Third rung	2.0%	
Fourth rung	12.7%	
Fifth rung	12.7%	
Sixth rung	18.7%	
Seventh rung	28.7%	
Eighth rung	18.0%	
Ninth rung	5.3%	
10th rung (highest)	0.7%	
AUDIT Score[b]	10.72	2.13
Drinking days in past 30 days[c]	8.26	4.95
Mean standard drinks in past 30 days[c]	4.52	2.20
Mean BAC in past 30 days[c]	0.10	0.06
YFAS Score[d]	1.04	1.26
Body mass index	4.15	3.37
Underweight	9.5%	
Normal	56.1%	
Overweight	28.4%	
Obese I	5.4%	
Obese II	0.7%	

[a]Subjective socioeconomic status was measured by the MacArthur Ladder.

[b]AUDIT = Alcohol Use Disorders Identification Test Score; scores can range from 0 to 40.

[c]Drinking days, mean standard drinks, and mean Blood Alcohol Concentration (BAC) in past 30 days were measured by Timeline Follow Back.

[d]YFAS = Yale Food Addiction Scale Score; symptom counts can range from 0 to 7.

Procedure

The university institutional review board approved the procedure in accordance with the provisions of the

World Medical Association Declaration of Helsinki. All participants were scheduled for one laboratory session between 4 and 8 PM. Study information (which blinded participants) was that the study tested how alcohol cravings function in everyday settings like restaurants and movie theaters. Study staff was not blind to condition; however, staff was not informed of hypotheses. To limit confounding, participants were instructed to: (a) not consume caffeine 4 hr prior to the session, (b) to not exercise or smoke 3 hr prior to the session, (c) to not consume food 1 hr prior to the session, and (d) to not drink alcohol the day of the session. The researcher verbally confirmed with participants that they had adhered to these instructions and, if the participant did not confirm adherence, their session was rescheduled. Participants also completed a questionnaire online prior to their session; this included measurement of demographics and individual differences (see Supplementary Materials).

At the in-person session, participants were led into a private testing room where they provided written informed consent. Then participants were attached to noninvasive physiological monitoring equipment, including electrode sensors adhered to their chests (BIOPAC Systems, Inc., Goleta, CA). Participants were reminded to avoid touching sensors, to sit still while allowing themselves to feel comfortable, and to keep their legs uncrossed. Participants underwent a 3 min relaxation period to adjust to the equipment [14].

Next, the researcher executed the alcohol-craving paradigm; this paradigm is well validated and craving induced by it predicts future drinking [14, 15]. The researcher brought two covered trays into the testing room and removed the cover off one tray to first reveal a water bottle and an empty glass (neutral cue used to acquire baseline alcohol cravings). The researcher opened the bottle, poured the water into the glass, placed the glass in front of the participant, and started playing the audio recording. Participants were instructed to sniff inside the glass when they heard high tones and stop sniffing when they heard low tones. The procedure was 3 min long and included 13 5 s olfactory exposures [14]. Immediately after the audio recording ended, participants responded to a visual analog scale measuring alcohol craving. Next, the researcher repeated this procedure with a bottle of the participant's selected alcohol beverage (alcohol cue).

After exposure to the alcohol cue, participants were randomly assigned to eat sweets (n = 60), eat calorie-equivalent bland food (n = 60), or watch a neutral video (n = 30). Caloric amounts were manipulated as described below. Participants were all given 6 oz. of water [16]. After 15 min, the researcher repeated the alcohol-craving paradigm with the participant's selected alcohol beverage, and participants responded to a third visual analog scale measuring alcohol craving. Participants were lastly led through a funneled debrief and were compensated $40 plus any incurred parking fees.

Materials

Alcohol cue

To determine the alcohol beverage in the alcohol-craving paradigm, participants were provided with a five-item list of alcoholic beverages including beer, wine (red or white), champagne, vodka, and rum. Pilot study raters (N = 385) determined the items on the list by ranking different kinds of alcohol from most to least pleasurable. Participants selected the alcohol from the list that they personally considered the "most palatable and rewarding" [17].

Sweets

To determine the sweets participants ate, participants were provided with a five-item list of sweets, including ice cream, cookies, cupcakes, chocolate, and brownies. Pilot study raters (N = 73) determined the sweets on the list by ranking different sweets from most to least comforting. Participants selected the sweets from this list that they personally considered the "most palatable and rewarding." Participants received 150 or 450 calories (n = 30 each). The amount of 150 calories were selected because it was approximately (±10 calories) one serving according to nutrition facts labels. The amount of 450 calories were selected because eating ≤450 calories may align with the ideology of a harm reduction approach [18]. In other words, eating ≤450 calories of sweets may be a viable alternative to drinking alcohol and experiencing harmful consequences [18]. Yet, eating >450 calories of sweets could present other health risks [19].

Bland food

Participants ate corn tortillas in the bland food condition. This control condition was included to control for the potential effect of any eating behavior/caloric intake on alcohol cravings. Pilot study taste testers (N = 8) determined this item by consuming several bland foods (corn tortillas, bread, pita bread, cereal, and unsalted corn tortilla chips) and rating corn tortillas as "least palatable and rewarding." Participants received 150 or 450 calories (n = 30 each) of corn tortillas to match the sweets conditions.

Neutral video

Participants watched "How it's made: Hearing aids, 3-D puzzles, rubber mats, and toilets" [20]. This extra control condition was included as an active, nonfood control.

Measures

Alcohol Use Disorder Identification Test [10]

The Alcohol Use Disorder Identification Test is a 10-item self-report (or interview) questionnaire that

identifies individuals with harmful patterns of alcohol intake. A sample item is, "How often during the last year have you found that you were not able to stop drinking once you had started?" Participants rate items categorically, and response options for each item are converted into a score ranging from 0 to 4 and are summed (higher scores indicate more harmful patterns of alcohol intake).

Yale Food Addiction Scale [13]

The Yale Food Addiction Scale is a 27-item self-report questionnaire that measures addictive-like eating responses to highly processed food based on the Diagnostic and Statistical Manual of Mental Disorders 4th edition criteria for substance dependence. A brief version with nine items was used for the current study [21]. A sample item is, "I have had physical withdrawal symptoms such as agitation and anxiety when I cut down on certain foods." Participants rate items on a five-point Likert scale (0 = "Never," 4 = "4+ times per week") or dichotomously (yes/no), and whether or not ratings meet the "diagnostic" threshold for a "food addiction" symptom is determined. All symptom values are summed.

Alcohol Craving

Visual analog scale

Participants responded to the question "How much do you crave alcohol right now?" on a sliding scale ranging from 0 to 100 [1]. The scale was anchored with "Not at all" at 0 and "Extremely" at 100. As expected, scores on the scale significantly increased from baseline to after the first alcohol cue, $\beta = 1.92$, $SE_{\beta} = 0.11$, $p < .001$, 95% confidence interval (CI: 1.70, 2.14).

Heart rate

Heart rate was continuously measured and then reduced with MindWare software (MindWare Technologies, Ltd., Gahanna, OH). Heart rate data were reduced into seven 1 min epochs: a 1 min epoch following baseline and three 1 min epochs following the first and second alcohol cues. Epoch means (bpm) were calculated. Similar to scores on the visual analog scale, heart rate significantly increased from baseline to after the first alcohol cue, $\beta = 0.48$, $SE_{\beta} = 0.07$, $p < .001$, 95% CI (0.34, 0.62). We interpreted this as evidence that greater heart rates indicated greater alcohol craving in the current study; however, it should be noted that scores on the visual analog scale did not correlate with heart rate. The discordance between self-report and physiological measures is common in the alcohol craving literature, and it suggests that some aspects of craving occur outside of conscious awareness [1].

Data Analytic Plan

The data analytic plan was preregistered on the Open Science Framework (https://osf.io/cugw2), and data and syntax are publicly available on the Open Science Framework at (https://osf.io/fe6u7/). Initial descriptive examination indicated that only alcohol craving measured via the visual analog scale evidenced skew (>1) and kurtosis (>3). Natural log transformations were thus performed.

Multilevel growth modeling was conducted to test the hypothesized effects of experimental conditions on changes in alcohol craving from after the first to after the second alcohol cue. Time was entered at Level 1. Baseline alcohol craving was entered as a time invariant covariate at Level 2. Dummy codes were entered at Level 2 to test the effect of sweets versus bland food (bland food = 0, sweets = 1) and the effect of sweets versus no food (no food = 0, sweets = 1). To test for effects of caloric amounts, another dummy code was entered at Level 2 (150 calories = 0, 450 calories = 1) along with a cross-product interaction term with food type. Random effects for time intercept and slope were included due to better model fits with inclusion, visual analog scale: Δ-2LL = −7.70, $p = .006$, heart rate: Δ-2LL = −85.40, $p < .001$.

Results

No differences in demographics or baseline alcohol craving by condition were found (ps > .15). Means and standard errors of alcohol craving by condition across time points are presented in Figs. 1 and 2. Results indicated there were no differences in changes in alcohol craving between participants who ate sweets versus bland food, visual analog scale: $\gamma = -0.14$, $SE_{\gamma} = 0.12$, $p = .27$, 95% CI [−0.39, 0.11], heart rate: $\gamma = -0.13$, $SE_{\gamma} = 0.20$, $p = .53$, 95% CI [−0.52, 0.27]. Results indicated there also were no differences in changes in alcohol craving between participants who ate sweets versus no food, visual analog scale: $\gamma = -0.20$, $SE_{\gamma} = 0.14$, $p = .16$, 95% CI [−0.47, 0.08], heart rate: $\gamma = -0.22$, $SE_{\gamma} = 0.24$, $p = .36$, 95% CI [−0.70, 0.26]. Moreover, results indicated there was no interaction between food type and caloric amount, visual analog scale: $\gamma = -0.36$, $SE_{\gamma} = 0.25$, $p = .15$, 95% CI [−0.85, 0.14], heart rate: $\gamma = 0.26$, $SE_{\gamma} = 0.40$, $p = .52$, 95% CI [−0.54, 1.05], and no main effect of caloric amount, visual analog scale: $\gamma = -0.02$, $SE_{\gamma} = 0.13$, $p = .86$, 95% CI [−0.27, 0.23], heart rate: $\gamma = 0.21$, $SE_{\gamma} = 0.20$, $p = .29$, 95% CI [−0.18, 0.61].

Discussion

Alcohol craving is a key experience leading to alcohol use [2, 3], and interventionists have largely targeted

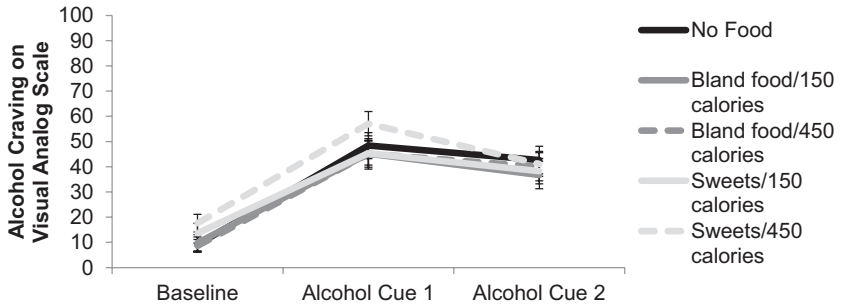

Fig. 1. Alcohol craving on visual analog scale by experimental condition. Vertical bars indicate standard errors.

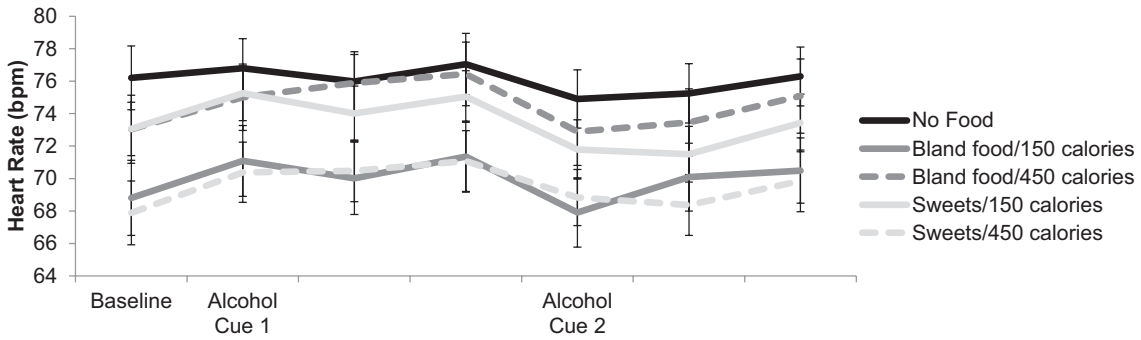

Fig. 2. Heart rate (bpm) by experimental condition. Vertical bars indicate standard errors.

alcohol cravings to decrease alcohol use [4, 5]. A popular belief backed by Alcoholics Anonymous is that individuals can allay alcohol cravings by eating sweets [6]. However, empirical support for this strategy is limited to a few preclinical studies in rats. To fill the gap in the scientific literature, the current study experimentally tested the acute effect of sweets on alcohol cravings in a human sample with at-risk drinking. Results indicated that eating sweets did not reduce alcohol cravings compared to control (bland food or a neutral video).

Prior preclinical studies in rats have found evidence that sweets intake reduced alcohol intake, yet effects were inconsistent and dependent on amounts of sucrose/saccharin solutions [8, 9]. It is difficult to directly compare sweets amounts between rat and the current human research but findings may conflict because participants ate only ≤450 calories of sweets. Future clinical research could test if eating >450 calories of sweets acutely reduces alcohol cravings. However, the clinical usefulness of such research is debatable given that elevated sweets intake could increase risk for poor physical health [19].

The current results should be interpreted in light of limitations. This study tested for acute effects on alcohol cravings with an eating manipulation that lasted 15 min and two alcohol-craving exposures that lasted 3 min each. It is possible that testing the chronic effects of eating sweets on alcohol cravings might produce different results. Moreover, this study tested effects in a younger sample with at-risk drinking but different effects may be observed in samples with alcohol use disorder—the population to which Alcoholics Anonymous' advice is targeted. The latter limitation should be emphasized because—although those with at-risk drinking experience alcohol craving in response to alcohol cues—those with alcohol use disorder tend to experience higher levels of craving [1]. Detecting the effect of eating sweets, thus, may be more methodologically/statistically difficult in those with at-risk drinking versus alcohol use disorder. Also, different effects may be observed in samples seeking treatment or in samples practicing alcohol abstinence because research has shown important clinical differences between those with alcohol use disorder who do or do not seek treatment [22]. Future research should test for acute and chronic effects of eating sweets on alcohol cravings in the aforementioned groups. For instance, researchers could randomize those with alcohol use disorder to eat ≤450 calories of sweets daily for 5 days [9] and then observe effects on daily and tonic alcohol cravings across the week. Future research should also consider measuring potential mediators of effects such as self-control capacity. Indeed, self-control theory posits that engaging in less self-control earlier (e.g., eating sweets) could increase self-control later (e.g., decrease alcohol cravings) [23]; cf. [24]).

The present study, nonetheless, had several methodological strengths. The study was a randomized between-subjects repeated measures experiment with multimethod measurement of alcohol craving (self-report and heart rate). Having participants select alcohol cues and sweets that they personally considered rewarding enhanced

ecological validity. Additionally, caloric amount of sweets were manipulated and individual differences were measured (see Supplemental Materials) so as to test for potential modifying factors. Finally, the hypotheses, data analytic plan, and data/syntax were preregistered/publicized, with the goal of reducing experimenter bias.

In sum, the current experimental findings did not provide evidence to support the clinical lore that eating sweets can reduce alcohol cravings, albeit only acutely and for those with at-risk drinking. Future research should prioritize determining whether eating minimal amounts of sweets can have clinically significant, beneficial, and long-term effects on alcohol craving in those with alcohol use disorder. Until there is clinical evidence to show that eating sweets is an effective strategy for managing alcohol cravings, empirically supported strategies for managing alcohol cravings (e.g., pharmacotherapies, mindfulness) could instead be promoted [4, 5]. This may be especially important to consider in light of growing evidence that sweets may facilitate addictive-like eating [25] and that elevated sweets intake is associated with physical health outcomes such as dyslipidemia, hypertension, cancer, and premature death [19]. Interventionists may, therefore, consider a concurrent goal of reducing alcohol cravings whilst not encouraging sweets intake.

Supplementary Material

Supplementary material for this article is available on the *Annals of Behavioral Medicine* website.

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Compliance with Ethical Standards

Authors' Statement of Conflict of Interest and Adherence to Ethical Standards The authors have no competing financial interests to declare.

Authors' Contributions J.R.C. conducted the literature review. J.R.C., L.A.R., and A.J.T. designed the study. J.R.C. and A.J.T. acquired study funding. P.N. collected data. J.R.C. oversaw data collection, analyzed and interpreted data, generated tables and figures, and wrote the initial draft of the manuscript. P.N. verified data analysis. All authors were involved in writing the paper and provided final approval of the manuscript.

Ethical Approval This research was approved by the University of California, Los Angeles Institutional Review Board (IRB#15-001045). All procedures were conducted in accordance with the ethical standards of this committee and the provisions of the World Medical Association Declaration of Helsinki.

Informed Consent All individuals who participated in the study provided informed consent.

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