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Deliberate induction of alcohol tolerance: empirical introduction to a novel health risk

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Abstract

Aims—Alcohol tolerance is a hallmark indicator of alcohol dependence. Even so, the allure of peers' admiration for having the ability to drink heavily may lead some adolescents and young adults to practice, or 'train', to increase their tolerance (particularly at US colleges, where heavy drinking is highly prevalent and central to the social culture). This is a potential health hazard that has not been documented empirically. Thus, we initiated a study of tolerance 'training' and its association to risky and heavy drinking.

Design, setting and participants—A cross-sectional online survey of 990 college student life-time drinkers at a large Midwestern US university.

Findings—Of the sample, 9.9% ($n = 97$) reported deliberately 'training' to increase tolerance. On average, they reported increasing from approximately seven to 10 US standard drinks in a night prior to 'training' to 12–15 drinks at the end of 'training,' over approximately 2–3 weeks' duration. Although the proportion of frequent binge drinking among 'non-trainers' (34.4%) was similar to national rates, 'trainers' were much more likely to be frequent bingers (76.3%; $OR = 6.15$).

Conclusions—A number of students report deliberately inducing alcohol tolerance, probably directly increasing the risk for alcohol poisoning and other acute harms and/or dependence. This phenomenon might additionally be applicable to other populations, and deserves further study and attention as a potential personal and public health risk. Prevention efforts might aim to reduce the perceived importance of heavy-drinking abilities.

Keywords

Alcohol dependence; heavy drinking; symptom; tolerance; training

INTRODUCTION

Alcohol tolerance, defined as (1) the need for noticeably increased amounts of alcohol in order to achieve the desired effect or (2) diminished effect with continued use of the same amount, is a hallmark diagnostic criterion of alcohol dependence [1–2] and is associated

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Declarations of interest

None.

with myriad health risks (e.g. blackouts, morning drinking [3]). Because alcohol tolerance has such negative implications, it is not viewed typically as an attribute that individuals would seek out voluntarily.

Nevertheless, some individuals may pursue acquiring tolerance. In many US colleges, heavy drinking is highly prevalent [4] and often associated with many harmful or even fatal outcomes [5]. However, heavy consumption is sometimes viewed as a social asset, or a way to earn peer admiration via being able to drink more than others before feeling the effects [6]. Thus, rather than working to avoid tolerance, students may practice, or ‘train’ (as an athlete trains for a competitive event), to increase their tolerance for alcohol at heavy drinking events.

Such ‘training’ has not yet been studied empirically, although some entertainment media make reference to the phenomenon [7]. Even so, ‘training’, if it occurred with any frequency in the population, could pose a harmful personal and public health risk. Thus, we initiated an empirical investigation in a sample of 990 US college student drinkers by surveying whether they ever engaged in this behavior. We also surveyed them about the specifics of ‘training’, and we estimated its association with heavy and risky drinking.

METHODS

Participants and procedure

Following approval from the university Institutional Review Board, we offered credit for participating in an online survey to all students enrolled in introductory psychology at a large Midwestern US university. This course has the highest enrollment of any course on campus [8]. A total of 1069 unique individuals consented and completed the survey. We excluded individuals reporting that they never drank any alcohol in their lives ($n = 79$), yielding a sample of 990. Consistent with the overall introductory psychology class, this sample averaged 18.70 [standard deviation (SD) 0.92; range 18–24] years of age, was 80.5% first-year, 54.5% female and 86.8% white/non-Hispanic. The sample is similar to the university with regard to sex and race [8].

Measures and analyses

We asked students: ‘in the past 12 months have you ever prepared (“trained”) for a future heavy-drinking event by drinking more and/or more frequently than normal in the days leading up to the event in order to improve tolerance?’ (0 = no, 1 = yes). Students indicated how many (US) standard drinks they could drink in a night at both the beginning and end of ‘training’ (1 = one drink, 2 = two drinks, 3 = three–four drinks, 4 = five–six drinks, 5 = seven–eight drinks, 6 = nine–11 drinks, 7 = 12–15 drinks, 8 = 16–18 drinks, 9 = 19–24 drinks, 10 = 25 or more drinks), the duration of time it took them to ‘train’ to their reported tolerance level (1 = 1 week, 2 = 2 weeks, 3 = 3 weeks, 4 = 4 weeks or 1 month, 5 = more than 4 weeks or 1 month), and whether they used each of three types of alcohol (beer, wine, hard liquor: 0 = no, 1 = yes). Also, students indicated the occasions for which they ‘trained’: a Friday night/weekend, spring break (i.e. vacation/holiday in springtime), end of the school year, (American) football game, birthday, Homecoming, graduation, New Year’s eve,

Halloween, St Patrick's day, Superbowl (i.e. famous American football tournament), wedding, my 21st birthday and (American) Independence day (0 = no, 1 = yes). Students indicated how true it was for them that they 'trained' for each of these reasons: I didn't want to pass out early in the celebration; I wanted to keep up with others' drinking; I didn't want to have to think about the amount that I drank and whether it would affect me; I wanted to break my own record; I wanted to impress my friends (0 = not at all true, 1 = a little true, 2 = moderately true, 3 = quite true, 4 = extremely true). Open fields invited respondents' comments [other 'training' events: beer pong tournament, beer olympics, drinking contest, beer fest, formal (dance), senior trip, cruise, float (boating) trip, vacation. another reason for 'training': 'I wanted to win beer fest'].

We estimated whether 'training' was associated with sex, race and fraternity/sorority (i.e. Greek) membership (as drinking is comparatively high in males, whites and Greek members [9]). We used logistic regression to estimate the likelihood of 'training' from these (dichotomous) variables.

We also estimated the relation between 'training' and heavy/risky drinking (using logistic regression). Frequent binge drinking was assessed by reports of having had five or more (males) or four or more (females) (US) standard alcoholic drinks in within a 2-hour period as often as once a week or more in the past 12 months. Frequently getting drunk was assessed by reports of getting drunk on alcohol as often as once a week or more in the past 12 months. The consumption of 12 or more (US) standard alcoholic drinks within a 24-hour period during the life-time was assessed. Whether students ever 'booted and rallied', or vomited after drinking alcohol and immediately started drinking again in the life-time, was also assessed (all drinking variable scales: 0 = no, 1 = yes).

RESULTS

Ninety-seven individuals (9.9% of the sample) reported having 'trained'. Men were more likely than women to 'train' [odds ratio (OR) = 3.68, 95% confidence interval (CI) = 2.31–5.89], and Greeks were more likely than non-Greeks to 'train' (OR = 1.78, 95% CI = 1.17–2.73). There were no group differences in 'training' status as a function of age, class year or race. During 'training', students reported increasing drinking from approximately seven–10 to 12–15 standard drinks in a night over approximately 2–3 weeks ($t_{90} = 11.90, P < 0.001$); for women, five–six to nine–11 ($t_{21} = 9.18, P < 0.001$) and for men, eight–11 to 12–17 ($t_{68} = 9.37, P < 0.001$).

Table 1 shows additional characteristics of 'trainers'. For example, individuals endorsed 'training' for a number of events and reasons, with a Friday night/weekend being the most popular event, and not wanting to pass out too early being the most popular reason. Individuals reported 'training' for an average of three events (range = 0–13, where 22.7% reported 'training' for just one event and 67.0% 'trained' for three or fewer). Although men were more likely to 'train' in general, they were less likely than women to 'train' for a birthday (OR = 0.33, 95% CI = 0.13–0.89) or for spring break (OR = 0.37, 95% CI = 0.14–0.93), social events often associated with extremely high consumption [10–11]. These were the only sex differences in events or reasons for 'training', and there were no race

differences. Greeks, however, were more likely than non-Greeks to ‘train’ for Superbowl (OR = 7.73, 95% CI = 1.59–37.52), a football game (OR = 4.05, 95% CI = 1.54–10.64), birthday (OR = 3.68, 95% CI = 1.40–9.69), spring break (OR = 3.32, 95% CI = 1.36–8.12) and Homecoming (OR = 2.72, 95% CI = 1.01–7.28).

Table 1 also shows that ‘trainers’ are far more at risk than their counterparts for heavy and risky drinking. Notably, the rate of frequent binge drinking in non-‘trainers’ (34.4%) is roughly comparable to the 2-week prevalence of binge drinking in a nationally representative sample of full-time college students (40.0%) [4], while the rate is much higher in ‘trainers’ (76.3%). Differences hold when statistically controlling for sex, race and Greek membership.

DISCUSSION

Our findings indicate that ‘training’ to increase alcohol tolerance is a risky phenomenon in a non-trivial number of college students. Notably, the majority of the sample (95.4%) was under the US legal drinking age (i.e. 21 years), suggesting ‘training’ occurred before students could legally drink. When young adults deliberately induce tolerance, they may increase the risk of alcohol poisoning and may prompt associated symptoms of alcohol dependence [12]. Importantly, these findings are potentially applicable to young adult populations in many countries where heavy drinking is problematic [13] and real or imagined social status is afforded to those who can ‘hold their liquor’.

‘Training’ challenges professional conceptualizations of the desirability of alcohol-related pathology, although it should not be surprising that many youths would want to drink at a party without feeling too intoxicated, sedated or sick. Nevertheless, some of these individuals, rather than moderating drinking to avoid negative consequences (and reduce risk), opt to enhance tolerance and, presumably, increase their likelihood of becoming alcohol-dependent.

Notable limitations of this work can inform future research directions. For example, no ‘training’ questionnaire existed previously, and it could certainly have been more exhaustive (e.g. including questions about drinking games, ‘training’ goals and additional alcohol measures and correlates) and more rigorous (e.g. counterbalancing questions to reduce respondent biases). It did not delineate fully whether ‘training’ is employed for specific events, or for becoming a ‘better’ heavy drinker in general. Furthermore, longitudinal research could capture more effectively ‘training’ processes, drinking behaviors, tolerance increases over time, the durability of induced tolerance and could address the alternative hypothesis that ‘training’ reflects incidental increases in tolerance (and exists merely as a way to rationalize increased tolerance as an *intended* result). Nationally representative and cross-national studies could help to determine the full scope of the problem, also elucidating whether ‘training’ may be a function of minimum legal drinking age laws.

This phenomenon has clear implications for alcohol intervention efforts. That is, both prevention and treatment interventions might be developed to reduce the appeal of ‘training’, or the perceived importance of ‘badges of honor’ associated with heavy drinking.

Similarly, cognitively reframing such ‘badges’ as ‘symptoms’ of dependence might help drinkers to view the dark side of increased tolerance. Educational and feedback-based interventions might incorporate some discussion on this possible paradox for students, that increased tolerance seems beneficial (by presumably allowing more drinking with less sickness) although is indeed quite harmful.

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Table 1

'Training' to increase alcohol tolerance ($n = 97$).

	% (versus non-'trainers,' $n = 884$)	OR _{individual}
Demographic characteristics:		
Under legal drinking age (i.e. 21 years)	93.8 (versus 95.5)	0.72
Male	73.2 (versus 42.6)	3.68*
White/non-Hispanic	92.7 (versus 86.5)	1.22
Greek (fraternity/sorority) member	44.8 (versus 31.3)	1.78*
'Trained' with:		
Beer	78.4	
Hard liquor	47.4	
Wine	12.4	
'Trained' for the following event:		
A Friday night/weekend	54.6	
Spring break	33.0	
End of the school year	32.0	
Football game (US)	26.8	
Birthday	25.8	
Homecoming	22.7	
Graduation	22.7	
New Year's Eve	22.7	
Halloween	18.6	
St Patrick's day	17.5	
Superbowl (US football tournament)	12.4	
Wedding	10.3	
My 21st birthday	9.3	
(US) Independence Day	5.2	
'Trained' because ^a :		
Didn't want to pass out early	83.5	
Wanted to keep up with others' drinking	81.8	
Didn't want to have to think about amount	75.8	
Wanted to break my own record	73.6	
Wanted to impress my friends	67.0	
Drinking variables		
Frequent binge drinking	76.3 (versus 34.4)	6.15*
Frequent getting drunk	80.2 (versus 36.2)	7.14*
12 drinks or more as a lifetime max	83.5 (versus 45.8)	5.99*
'Booted and rallied' 1+ times in life-time	78.4 (versus 32.8)	7.40*

OR: odds ratio.

^aPercentages are on a dichotomization of the ordinal scale where 0 = not at all true, 1 = true, and percentages reflect 'true'. 'Booted and rallied' is a colloquialism for continuing to drink after vomiting. All drinking variables: 0 = no, 1 = yes.

* $P < 0.01$.

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