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Is the Deliberate Self-Induction of Alcohol Tolerance Associated with Negative Alcohol Outcomes?

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Abstract

Research indicates 10% of college student drinkers report deliberately training to increase alcohol tolerance (a diagnostic criterion for alcohol use disorder) to avoid passing out early or to keep up with peers. Given that tolerance training may be considered a harm reduction technique designed to reduce acute aversive consequences, we examined the associations between tolerance training and the use of protective behavioral strategies (PBS) more generally. A cross-sectional survey of 1,080 lifetime drinkers was conducted at a large Midwestern university. Of this sample, 5.6% ($n=60$) reported training to increase their tolerance. Drinkers who endorsed having trained to increase tolerance reported notably more alcohol-related problems than those who reported never training ($M_{adj}=51.80$ versus $M_{adj}=39.30$; $p<.0001$). Further, participants who endorsed tolerance training reported utilizing significantly *fewer* PBS (e.g., avoid drinking games) on the Protective Behavioral Strategies Scale (PBSS, Martens et al., 2005) than participants who had never trained ($M_{adj}=16.89$ versus $M_{adj}=18.90$; $p<.01$). An exception was that drinkers who trained to avoid passing out early used significantly more PBS (e.g., using a designated driver, knowing where your drink is at all times). Despite this, these trainers consumed more alcohol and experienced more alcohol-related harms. The present findings support previous research demonstrating that trainers consume more alcohol than non-trainers, and provide further evidence that deliberately training to increase tolerance is indicative of problematic drinking behavior. Prevention efforts might aim to inform drinkers of the problems associated with deliberately inducing alcohol tolerance, and focus on developing alternative strategies for minimizing acute harm from drinking.

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Contributors

All authors were personally and actively involved in substantive work leading to the report and will hold themselves jointly and individually responsible for its content. Each author has approved the final manuscript.

Conflict of Interest

All authors declare that they have no conflicts of interest.

Keywords

alcohol tolerance training; risky alcohol use; protective behavioral strategies; alcohol consequences

Excessive alcohol consumption by college students is a well-documented problem (Johnston, O'Malley, Bachman, Schulenberg, & Miech, 2016; Strauss & Bacon, 1953). Collegiate drinking is associated with negative consequences, including unsafe sexual practices, driving after drinking, damaging property, unintentional injuries, and death (Hingson et al., 2009; Wechsler et al., 2002). Further, nearly 20% of college students meet past-year criteria for alcohol use disorder (AUD; Dawson et al., 2004; Slutske, 2005). A hallmark AUD criterion is *tolerance*, which is defined as either: need for increased amounts of alcohol to reach a desired effect, or diminished effect with the same amount of alcohol used (American Psychiatric Association, 2013). Prior research indicates that tolerance is associated with a range of alcohol-related problems (Schuckit et al., 2008), making it an undesirable trait. However, some college students report deliberate attempts to increase their alcohol tolerance (Martinez, Steinley, & Sher, 2010).

Martinez and colleagues (2010) assessed active attempts to increase alcohol tolerance in college students and found that 10% reported intentionally "tolerance training." These "trainers" tended to be male, affiliated with Greek organizations, and endorsed increasing consumption by approximately five drinks per drinking occasion while training. Individuals endorsed training for reasons suggesting that it is perceived as a socially desirable trait among college students (e.g., keeping up with others and impressing friends; see Johnson & Sheets, 2004; Mallett, Lee, Turrissi, & Larimer, 2009; also see Mallett, Varvil-Weld, Turrissi & Read, 2011). Yet, the prevalence of binge drinking and drinking to intoxication was twice as high among trainers as non-trainers, suggesting that training was associated with excessive and harmful use.

Although tolerance training appears maladaptive from a public health perspective, such deliberate behavior may alternatively reflect a future-oriented intention to reduce possible harms from alcohol (at least from the perspective of the students, who report training for the purposes of avoiding undesired consequences like not passing out early; Martinez, et al., 2010). Such planned efforts do not appear to reflect impulsiveness, and from the student-drinker perspective, tolerance training might even be viewed as a type of harm reduction (albeit one that might have a net harmful effect; Weatherburn, 2009). However, it is unclear how such students utilize established strategies designed to reduce harm when drinking.

Protective behavioral strategies (PBS; e.g., avoiding drinking games, drinking water between alcoholic beverages) are behaviors aimed to promote responsible drinking (Martens et al., 2005). They are related to less alcohol consumption (Benton et al., 2004; Martens et al., 2005), fewer alcohol-related problems (Benton et al., 2004; Delva et al., 2004; Martens et al., 2004), and they mediate and moderate the relation between risk factors for alcohol misuse and alcohol-related outcomes (LaBrie et al., 2011; Martens et al., 2008; Martens et al., 2009; Weaver, Martens, & Smith, 2012). Tolerance training differs from PBS because it requires increased as opposed to decreased alcohol consumption. If tolerance training

indicates problematic use and is practiced to prevent future unwanted experiences associated with lower tolerance (e.g., not keeping-up with friends, passing out early), then it is likely that trainers also utilize fewer PBS to decrease their alcohol consumption. The present study replicated and extended Martinez et al. (2010) using a more comprehensive assessment of alcohol consumption and associated problems and examining the use of PBS.

Method

Participants

Participants ($N=1,262$) consisted of a convenience sample recruited from an introductory undergraduate psychology course at a large Midwestern University. Students received research credit for their participation. This study was approved by the University's Institutional Review Board, and informed consent was obtained. Exclusion criteria included abstinence from alcohol in the past 12-months ($n=118$), not providing information about alcohol use ($n=36$), or not responding to the tolerance-training item ($n=28$). Thus, 1,080 participants were included in the final analysis. The sample was predominately women (63%), White (86%), and underclasspersons (94% first-and second-year students), and the average age was 19.15 ($SD = 1.38$, range = 18-34)¹. In terms of missing data, those who were missing on 90% or more of the alcohol variables were more likely to be White ($OR=1.81$, 95% C.I. [1.11, 2.96]) and fraternity/sorority ("Greek") members ($OR=1.75$, 95% C.I. [1.08, 2.84]); however, there were no differences between groups on other demographic variables.

Measures

Tolerance training was assessed using the same question as Martinez and colleagues (2010) except not limited to the past 12 months: "have you ever prepared, or '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?" The modified version of the Daily Drinking Questionnaire (DDQ; Collins, Parks, & Marlatt, 1985) was used to assess alcohol consumption. Participants reported on typical drinking for each day over the past-year and typical drinking for each day during training periods. Weekday versus weekend drinking was calculated by summing the number of drinks reported for Sunday through Wednesday and Thursday through Saturday, respectively. Frequency of drinking to intoxication and frequency of binge drinking episodes in the past 30 days were assessed using an eight-point rating-scale ranging from "I did not get drunk [binge drink] in the past 30 days" to "got drunk [binge drank] everyday." These variables were dichotomized (i.e., 1=got drunk [binge drank] at least once in the past 30 days).

Past-year alcohol-related problems were examined using the 31-item Young Adult Alcohol Problems Screening Test (YAAPST; Hurlbut & Sher, 1992; $\alpha=.94$). The 15-item Protective Behavioral Strategies Scale (PBSS; Martens et al., 2005) was used to assess behaviors promoting less risky drinking. The PBSS is comprised of three subscales: *stopping/limiting drinking* (e.g., "stop drinking at a predetermined time"; $\alpha = .90$), *manner of drinking* (e.g.,

¹Notably, due to a programming error, age is based on 30% of the sample.

“avoid drinking games”; $\alpha=.67$), and *serious harm reduction* (e.g., “use a designated driver”; $\alpha=.76$). Participants were asked to indicate the degree to which they use PBS when using alcohol or “partying.”

Results

Sixty participants (5.6%) reported tolerance training. As shown in Table 1, logistic regression analyses indicated that trainers and non-trainers were similar with respect to race/ethnicity and Greek affiliation, though were more likely to be male ($OR=4.81$, 95% C.I. [2.7, 8.6]). Students most frequently reported tolerance training for spring break and the end of the school year (Table 2). Consistent with previous findings, results from analysis of variance indicate that trainers *consumed* more standard alcoholic drinks than non-trainers in a typical week, even after adjusting for sex ($M_{adj}=21.64$, $SE=1.55$ versus $M_{adj}=10.66$, $SE=.40$; $F[1, 1003]=46.19$, $p<.0001$, partial $\eta^2=.04$). On average, trainers reported drinking more ($M_{adj}=2.93$, $SE=1.46$, $p=.049$) on training weekends than on non-training weekends and reported a similar, though nonsignificant, difference between training weekdays and non-training weekdays ($M_{adj}=2.73$, $SE=1.71$, $p=.09$). Table 2 provides comparisons between the sample of trainers in Martinez and colleagues' (2010) and the current sample.

Adjusting for sex, trainers reported more alcohol-related problems ($M_{adj}=51.80$, $SE=1.86$) in the past year than non-trainers ($M_{adj}=39.30$, $SE=.48$; $F[1, 1046]=25.61$, $p<.0001$, partial $\eta^2=.04$). This held even after adjusting for the use of PBS ($M_{adj}=51.15$, $SE=1.85$ versus $M_{adj}=39.31$, $SE=.48$; $F[1, 1022]=28.84$, $p<.0001$, partial $\eta^2=.04$) and typical use ($M_{adj}=47.16$, $SE=1.78$ versus $M_{adj}=39.16$, $SE=.45$; $F[1, 1000]=70.20$, $p<.0001$, partial $\eta^2=.02$). Neither sex as a main effect, nor sex-by-training interactions were statistically significant.

Trainers ($M_{adj}=16.89$, $SE=.66$) utilized fewer PBS on the *manner of drinking* subscale than non-trainers ($M_{adj}=18.90$, $SE=.17$; $F[1, 1023]=8.50$, $p<.01$, partial $\eta^2=.01$). There was a marginally significant effect on the *serious harm reduction* subscale ($F[1, 1024]=3.58$, $p=.06$) and no effect of training on the *stopping/limiting* subscale ($F[1, 1023]=1.73$, $p=.19$). No sex-by-training status interactions were found. Men reported using fewer strategies than women on the *serious harm reduction* subscale ($M_{adj}=13.41$, $SE=.25$ versus $M_{adj}=15.34$, $SE=.26$) $F[1, 1024]=73.01$, $p<.0001$, partial $\eta^2=.07$) and the *stopping/limiting* subscale ($M_{adj}=20.96$, $SE=.68$ versus $M_{adj}=23.84$, $SE=.70$; $F[1, 1023]=22.36$, $p<.0001$, partial $\eta^2=.02$).

Examining the relation between training motives and PBS while adjusting for sex, trainers intending to avoid passing out early used more strategies on the *serious harm reduction* ($M_{adj}=14.04$, $SE=.46$ versus $M_{adj}=12.08$, $SE=1.37$; $F[1, 55]=5.59$, $p=.02$) and the *stopping/limiting* subscales ($M_{adj}=21.71$, $SE=1.19$ versus $M_{adj}=18.38$, $SE=2.87$; $F[1, 55]=4.81$, $p=.03$); no other effects were significant. Marginally significant effects suggest trainers who drink to avoid passing out early consume more drinks per week ($M_{adj}=25.68$, $SE=3.07$ versus $M_{adj}=14.50$, $SE=3.64$; $t[54]=-1.80$, $p=.07$), drinks per weekday ($M_{adj}=7.07$, $SE=1.85$ versus $M_{adj}=.80$, $SE=.44$; $t[46.24]=-3.30$, $p=.002^2$), and experience more alcohol-related problems ($M_{adj}=54.42$, $SE=2.71$ versus $M_{adj}=43.85$, $SE=3.92$; $t[56]=-1.93$, $p=.06$).

Discussion

The current study replicated and extended prior research on the deliberate induction of alcohol tolerance. Overall, tolerance trainers consume more alcohol, experience more problems, and use fewer strategies for moderating alcohol consumption than non-trainers. Notably, trainers intending to avoid passing out early actually used slightly more strategies than trainers with other motives, suggesting the use of PBS is moderated by training motive. Though trainers intending to avoid passing out early utilize more PBS (e.g., using a designated driver, going home with a friend, knowing where your drink is at all times), these trainers also drink more and experience more alcohol-related harms compared to other trainers. Regardless of motive, trainers represent a high-risk group for excessive consumption and alcohol-related consequences, although the mechanisms responsible for this have yet to be determined.

There may be ostensibly harm-minimizing/-delaying strategies that actually increase harm by undermining normal biological or environmental constraints on drinking or hazardous alcohol-related behavior (Weatherburn, 2009). These strategies, from the drinker's perspective, may be designed to minimize harm but are actually ineffective and increase risk. For example, students have anecdotally reported avoiding driving on heavily trafficked, highly patrolled roads while intoxicated to reduce the risk of getting caught. Although this strategy may reduce the risk of a DUI, it could prove harmful in other ways (e.g., motor vehicle crashes) and may operate to the exclusion of the less harmful alternative of using a designated driver (a PBS).

Limitations

Tolerance training was assessed using a single yes/no question, so there is likely variability among trainers. Future research may consider developing an exhaustive questionnaire assessing training goals and correlates of heavy drinking. Also, the majority of the sample was underclasspersons; thus, it remains unclear whether tolerance training changes over time as individuals gain access to alcohol on their 21st birthday (which itself poses risks to students; Rutledge, Park & Sher, 2008; Schulenberg & Maggs, 2002) and as students' roles change.

Tolerance training should also be investigated in other populations. In some cultures it is common for co-workers to drink alcohol together after work, and it is considered inappropriate to turn down drinks from higher-ranked co-workers (Oh, 2016, June 25). Thus, these individuals may be motivated to train to "keep-up" with co-workers.

The cross-sectional nature of the data limits the ability to draw conclusions regarding temporal associations of tolerance training and its correlates. Finally, alcohol-related problems were assessed for the past-year and not specifically during a training episode. Thus, claims that trainers experience more problems when training cannot be made based on the present data.

²In this case, the Satterthwaite method was used because the assumption of equal variances was not met.

Future directions may assess training behavior using longitudinal designs over the course of the year to more accurately identify training periods, their duration, and immediate consequences. Daily diary assessments or ecological momentary assessments (EMA) may be useful for identifying and tracking training episodes. Prospectively assessing tolerance training would provide a greater understanding of how inducing alcohol tolerance alters subsequent drinking and consequences.

Summary

This study provides further documentation of the practice of training to improve alcohol tolerance, and evidence that tolerance training is an indicator of problematic use within an already at-risk sample (i.e., college students). These findings have implications for prevention and intervention programs. Personalized feedback interventions (PFIs), for example, could target tolerance training by including the prevalence and potential consequences (Scott-Sheldon, Carey, Elliot, Garey & Carey, 2014). As suggested by Martinez and colleagues (2010), providing feedback that reframes tolerance training as deliberately increasing risk for AUD would be consistent with material provided in PFIs. Further, PFIs may suggest strategies for minimizing acute harm from drinking, especially during commonly trained-for events.

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Highlights

- Prior research indicates individuals deliberately train to induce alcohol tolerance
- Use of protective behavioral strategies (PBS) among tolerance trainers was examined
- Current results replicate research indicating trainers drink more than non-trainers
- Tolerance trainers reported more alcohol-related problems and used fewer PBS
- Prevention efforts should inform of the problems with alcohol tolerance training

Table 1

Comparing Percentage of Trainers and Non-trainers on Demographic and Drinking-related Variables (N = 1,054)

	Trainer (<i>n</i> = 60)	Non-Trainer (<i>n</i> = 994)	<i>p</i>
Demographic Characteristics			
% Male	71.67	34.44	<.001
% White/non-Hispanic	86.67	85.61	<i>ns</i>
% Greek (fraternity/sorority) member	40.00	37.73	<i>ns</i>
Drinking Variables			
% Reporting "drunk"	93.33	76.67	<.01
% Reporting binge drinking	95.00	73.94	<.001

Note. Both drunk and binge drinking were assessed based on the frequency of getting drunk and the frequency of binge drinking in the past 30 days, respectively. Both variables were dichotomized in order to report the frequency of being drunk or binge drinking between trainers and non-trainers.

Table 2

Characteristics of Trainers in the Current Sample Compared to a Previous Sample

	Current Sample (<i>N</i> = 60)	Martinez et al. (2010) (<i>N</i> = 97)
Percentage 'Trained' with:		
Beer	70.0	78.4
Hard Liquor	48.0	47.4
Wine	16.7	12.4
Percentage of trainers who 'Trained' for the following events:		
Spring break	33.3	33.0
End of the school year	33.3	32.0
Halloween	26.7	18.6
A weekend	25.0 ^a	54.6 ^a
Birthday	26.7	25.8
Homecoming	25.0	22.7
A Friday night	20.0 ^a	--
New Year's Eve	18.3	22.7
Football game (US)	18.3	26.8
St. Patrick's day	20.0	17.5
Graduation	18.3	22.7
My 21st birthday	15.0	9.3
Super Bowl	13.3	12.4
Someone else's 21st birthday	11.7	--
Wedding	10.0	10.3
Independence Day (US)	8.3	5.2
Percentage 'Trained' because:		
Wanted to keep up with others' drinking	81.4	81.8
Didn't want to pass out early	77.6	83.5
Wanted to break my own record	76.3	73.6
Didn't want to have to think about amount	70.0	75.3
Wanted to impress my friends	69.5	67.0

Note.

^aThe original article (Martinez et al., 2010) measured *Friday* and *Weekend* variables as a single item. The intraclass correlation between the present sample and the prior sample (minus a weekend, a Friday night, and someone else's 21st birthday) is .99 suggesting strong replicability between the two samples.