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Does it Work and Does it Last? Effects of Social and Drinking Behavior on Same and Next Day Mood

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Abstract

Both social and drinking behavior have the potential to modify mood. However, if social drinking enhances positive mood and reduces negative mood, as compared to non-drinking social behavior, then interventions to reinforce non-drinking via sober social activity are undermined. Using multilevel modeling analyses, we compared end-of-day mood on drinking days versus non-drinking days, and on days spent with other people as compared to days spent primarily alone. We evaluated the interaction between drinking/non-drinking and social/solitary behavior and assessed whether the effects of social and drinking behavior extended to mood the next day. Participants were 352 college students (53% female; 55% fraternity/sorority membership; mean age 19.7 years) who completed three automated telephone surveys each day during four 14-day intervals over 1 year. Drinking and being social were associated with higher end-of-day positive mood and significantly lower end-of-day negative mood. However, no positive enhancement or negative attenuation effects of alcohol were observed in interaction analyses. Alcohol provided no improvement in mood over-and-above being social at the end of the day or on the following day. However, drinking the previous day significantly reduced next-day positive mood, whereas being social significantly reduced next-day negative mood. These findings provide support for the reinforcing potential of interventions that increase rewarding social activity in the place of alcohol use.

Keywords

Alcohol; Social behavior; Mood; College

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1 Introduction

1.1 Alcohol consumption, social behavior, and mood

Alcohol consumption is common among college students, with 62% reporting use within the past 30 days and 32.9% reporting heavy episodic use within the past 2 weeks (Schulenberg et al., 2018). Alcohol use occurs in both social and solitary settings, which may be determined by mood (Mohr et al., 2001). Close to half (45.9%) of college students report experiencing sadness within the past 30 days, and many report other forms of negative affect including anxiety (43.5%), anger (24.3%), and loneliness (43.1%; American College Health Association, 2017).

Numerous studies associate alcohol use and social activities with mood. Mood is typically conceptualized as a predictor, mediator, or moderator of drinking (Cooper, Frone, Russell, & Mudar, 1995; Grant, Stewart, & Mohr, 2009; Hussong, Galloway, & Feagans, 2005; Kuntsche & Cooper, 2010; Park, Armeli, & Tennen, 2004; Wray, Simons, Dvorak, & Gaher, 2012). Mood induction paradigms demonstrate experimentally that negative mood can heighten craving (c.f., Rubonis et al., 1994; Sinha et al., 2009) and influences accessibility to alcohol outcome expectancies that serve to motivate alcohol use (Birch et al., 2004; Goldstein, Wall, McKee, & Hinson, 2004). Significant variation in mood has been observed between persons based on drinking (Hartley, Elsabagh, & File, 2004; Murphy, McDevitt-Murphy & Barnett, 2005; Townshend & Duka, 2005) and within persons over time (Sutker, Tabakoff, Goist, & Randall, 1983) and across settings (Schrieke et al., 2014). However, most studies of the relation between mood and alcohol use have only examined mood on drinking days (Park et al., 2004). Further research that assesses within-person variation in mood across drinking and non-drinking days (and social and non-social days) is needed to disentangle the individual, additive, and interactive effects of alcohol use and social interaction on mood. In addition, while there is a robust literature on mood as a predictor of drinking, research examining mood as an outcome of drinking behavior is much more limited, and only rarely do researchers examine variation in daily mood at both within- and between-person levels (Rankin & Maggs, 2006). Thus, theoretical understanding of interrelationships among drinking, non-drinking, social behavior, solitary behavior, and mood remains incomplete.

Study of mood states following drinking behavior is valuable for assessing the reinforcement rationale of behavioral interventions to reduce alcohol misuse. In behavior theory, mood is conceptualized as a behavioral reinforcer. For example, a positive mood state that occurs after a behavior would be expected to increase the likelihood of subsequent similar behavior (positive reinforcement). A decrease in negative mood after a behavior would also increase the likelihood of subsequent similar behavior (negative reinforcement). Based on principles of reinforcement, social behaviors and drinking behaviors would be expected to operate similarly, with end-of-day increases in positive moods or decreases in negative moods leading to repeat behaviors of either type.

Being in a social situation is generally associated with greater positive moods and lower negative moods than being alone (Pavot, Diener, & Fujita, 1990). Of course, social behavior (Diener & Seligman, 2002; Pavot et al., 1990) and drinking behavior (Sitharthan, Sitharthan,

& Hough, 2009; Smith, Parker & Noble, 1975; Stritzke, Patrick & Lang, 1995) have the potential to influence mood either independently or conditionally (Armeli, O'Hara, Ehrenberg, Sullivan, & Tennen, 2014; Mohr et al., 2013). In other words, the relationship between drinking and mood may depend on whether the person is in a social or solitary situation. Or, the relationship between social or solitary activities and mood may depend on whether the person is drinking. Negative social interactions and negative moods have been associated with substance use cravings among college students in recovery (Cleveland & Harris, 2010). In addition, compared to peers with more social supports, young adults with fewer social supports have been found to drink more in response to same-week negative moods, which then predicted increases in next-week negative moods (Hussong et al., 2001). Based on these findings, it is plausible that lack of social supports may prompt drinking. However, these studies did not examine mood as an outcome of social or drinking activities earlier that day or the previous day. Hence, complementary research is warranted that may better illuminate risks for increasing alcohol use over time through an examination of the reinforcing attributes of resultant positive and negative moods following social or drinking behavior.

Better understanding how drinking-related and non-drinking-related social behavior affects mood also has important clinical implications for prevention. Efficacious cognitive-behavioral interventions recommend replacing social drinking with rewarding non-drinking social activities to reinforce non-drinking over time (McCrady & Epstein, 2008). Research indicates that engaging in positively reinforcing alcohol-free activities protects against alcohol misuse (Murphy, Correia, & Barnett, 2007; Murphy et al., 2012). In experimental investigations, students who increase participation in alcohol-free social activities report lower levels of alcohol use than students who do not engage in these activities (Murphy, Barnett, Goldstein, & Colby, 2007; Murphy, Correia, Colby, & Vuchinich, 2005). Determining whether social activities compete with drinking in terms of positively and negatively reinforcing mood states informs further development of behavioral and behavioral-economic theories of drinking behavior, and, thereby, provides guidance for improving interventions to reduce misuse.

1.2 Study purpose

The purpose of the present study is to examine mood on days spent alone or with others, across both drinking and non-drinking days. Given prior research on the reinforcing properties of positive and negative mood states, we ask, "Does alcohol use or social activity improve end-of-day mood?" Day-level data suggest students who are experiencing negative mood may be more likely to drink alone, and conversely that students who are experiencing more positive mood are more likely to engage in social drinking (Mohr et al., 2008, 2013). But, without naturally occurring observations of each of the four possible situations—alone not drinking, alone drinking, social and drinking, social and not drinking—these studies do not clarify whether or how social or drinking activities during the day impact the role of end-of-day mood as behavioral reinforcement. Behavioral-economic approaches suggest alcohol is used to provide immediate reinforcement to reduce negative mood or increase positive mood, whereas many alcohol-free activities are associated with delayed outcomes. Therefore, we use daily cellphone assessments and a lagged analytic design to also ask the

question, “If it works, does it last (i.e., improve mood the next day)?” We seek to determine whether non-drinking with others is more or less reinforcing than drinking with others in terms of its impact on mood. We contextualize end-of-day and next-day mood states to understand how daily mood variability results from college students’ social and drinking behaviors and can inform interventions to reduce alcohol misuse.

2 Method

2.1 Participants

Participants were 352 college students (53% female; 55% members of a fraternity or sorority) with a mean age of 19.7 years old ($SD = 1.26$). In terms of race, participants identified as White (74%), multiracial (11%), Asian (9%), or “other” (6%). Participants were recruited via email from a large public university. The primary inclusion criterion was that the student endorsed drinking two or more times per week.

2.2 Procedures

Data were collected three times daily—morning (9:00 am–noon), afternoon (3:00–6:00 pm), and evening (9:00 pm–midnight)—via automated telephone interviews using interactive voice response (IVR) during four 2-week intervals over 1 year. The measure of mood was administered during the evening (end-of day) interview, whereas the measures of the participant’s behavior (drinking versus not drinking, social versus alone) were administered in the morning the following day.

2.3 Measures

2.3.1 Social behavior.—During the morning interview, participants were asked “Yesterday, were you more often alone or with other people?” Scores were dichotomous (0 = primarily alone, 1 = primarily with others).

2.3.2 Drinking behavior.—During the morning interview, participants were asked “Did you drink any alcohol yesterday, from the time you got up to the time you went to sleep?” Scores were dichotomous (no = 0, yes = 1).

2.3.3 Mood.—We assessed baseline mood using 20 items from the Positive and Negative Affect Scales (PANAS), a frequently used measure of trait- and state-based mood (Schmukle, Egloff, & Burns, 2002; Watson & Clark, 1999; Watson, Clark, & Tellegen, 1988). Participants’ baseline PANAS scores assessed trait-level mood and demonstrated adequate internal consistency (positive mood: $\alpha = .87$; negative mood: $\alpha = .86$). State-based mood was assessed during the end-of-day interview. Participants were asked, “How did you feel in general today?” and response options ranged from 1 *not at all* to 9 *very much*. Positive mood items included *happy, relaxed, alert, excited* and *energetic*. Negative mood items included *lonely, angry, irritable, stressed* and *depressed*. The item averages were used to compute the mood scores. The daily positive mood state ($\alpha = .75$) and negative mood state ($\alpha = .79$) scales had adequate internal consistency in the present study.

2.4 Data analyses

All analyses were conducted using R v3.0.1 (R Development Core Team) using the *lme4* package (Bates et al., 2014). We used graphical and descriptive analytic approaches to confirm multi-level modeling assumptions were met. We used multilevel modeling analyses to assess within-person differences in end-of-day mood across two situations: a) non-drinking or drinking (0 or 1), and b) alone or social (0 or 1). To disentangle between-person from within-person effects, we also included between-person (Level 2) covariates for the percentage of days across the monitoring periods for the covariates of interest (i.e., percent of days drinking, percent of days social). Further, we included covariates for baseline PANAS scores, reported birth sex, whether the student endorsed participation in fraternities or sororities (0 = no, 1 = yes), and the day of the week (Hussong, 2007; Kennedy-Moore, Greenberg, Newman, & Stone, 1992; Kuntsche & Cooper, 2010). The first set of models examined associations of same-day drinking and social behavior with positive and negative mood. A second set of models examined prior-day drinking and social behavior by further inclusion of these covariates into the models described above. In addition to a random intercept, all multilevel models included random slopes for the within-person (Level 1) covariates of interest (i.e., drinking, social behavior).

We also assessed the impact of the interaction between any alcohol and social behavior on daily mood. Models with and without drinking by social behavior interaction terms were assessed using fit statistics for nested models.

3 Results

Across the course of this study, participants completed 85%, 87%, and 84%, of the morning, afternoon, and evening interviews, respectively. On average, participants provided data for 141 of possible 168 interviews ($SD = 40.8$, range: 2–168). For these analyses, data were collapsed into days, and we used 11,469 daily observations from 348 individuals. Roughly 36% of participants' total observed days included drinking behavior (Range for number of drinks: 0–26; $M = 1.94$, $SD = 3.34$). Approximately 69% of participants' total observed days were spent socially with others, and 93% of social days included drinking. Intraclass correlations indicated that approximately 27% of variability in positive mood was between persons and about 32% of variability in negative mood was between persons. As is displayed in Table 1, at the within-person level, end-of-day positive mood was higher on days when participants reported drinking and being with others after accounting for one's percentage of drinking and social behavior over the course of the study as well as other covariates. Similarly, drinking and social behavior on a given day were also each significantly associated with lower same-day negative mood. Also, at the between-person level, higher percentage of drinking days was associated with lower negative mood.

The next set of analyses included variables for prior-day drinking and social behavior into the models. As shown in Table 2, prior-day drinking behavior was associated with a significantly lower rating of next-day positive mood but was not significantly associated with next-day negative mood. Prior-day social behavior was associated with significantly lower next-day negative mood, but not next-day positive mood. Further, we continued to see

statistically significant associations of same-day drinking and social behavior with higher positive mood and lower negative mood.

We did not find evidence that social behavior and drinking interact to predict same- or next-day mood (no moderation). Review of Wald's tests, the deviance in the negative log likelihood ratio, and Akaike and Bayesian Information Criteria indicated that inclusion of interaction terms did not significantly improve the model fit.

4 Discussion

4.1 Conclusions

We found that participants reported a better overall mood on drinking days as compared to non-drinking days and on social days as compared to non-social days. Both drinking and being with others were associated with higher positive end-of-day mood and lower negative end-of-day mood. However, the results indicated a stronger association between social behavior and mood than with drinking behavior. In addition, the interaction between drinking and social activity was not significant. Alcohol did not enhance or diminish the effect of being social on mood. Thus, these findings are consistent with the theoretical rationale underlying non-drinking, socially-based behavioral interventions: being social without drinking was as rewarding as drinking in terms of self-reported end-of-day mood. Non-drinking social activities may serve as a reinforcing replacement activity to reduce alcohol misuse over time.

The benefits of replacing drinking with non-drinking social activity are more apparent when looking at mood the next day. Drinking the prior day was associated with reduced positive mood the next day, whereas being social the prior day was associated with reduced negative mood the next day. Thus, even though drinking may be associated with increases in positive mood in the moment, it does not last. By comparison, being social is associated with increases in positive mood in the moment and may serve to protect against negative mood the next day.

4.2 Implications

These findings have implications for prevention and intervention. First, psychoeducation on the potential benefits of non-drinking social activity on mood could be included as part of existing efficacious individual-focused interventions for high-risk drinking students (Cronce & Larimer, 2011). This knowledge may prompt students who are struggling with low mood to consider decreasing their alcohol consumption, especially if they have identified alcohol-free activities in which they would be willing to engage. At a population-level, clinicians in campus primary care settings could encourage self-monitoring of drinking and social behavior among students who report low mood during routine screenings. This allows students to detect associations between behaviors and mood the next day, which can serve as greater motivation for behavior change than providing psychoeducation alone. Finally, the findings from this study add to the literature supporting expenditure of campus resources to create more non-drinking social opportunities for students, consistent with evidence-based recommendations for environmental intervention (Toomey, Lenk & Wagenaar, 2007;

Toomey & Wagenaar, 2002). Such activities support the 20-30% of students who abstain from drinking, as well as those who do drink but may not wish to drink on a given occasion and would drink less if given opportunities for sober social interaction.

4.3 Limitations

Our study is limited to self-reported activities and mood. We did not measure all the possible daily variables that could influence end-of-day mood, nor did we assess the nature of the social activities engaged in (which could have included risky social behaviors), whether social activities during the day were subjectively experienced as positive or negative by participants, or how proximal drinking occurred in relation to social activity. In particular, it is possible that a person was primarily with others but drank alone, and vice versa. Future research would benefit from using ecological momentary assessment (EMA), which would allow more proximal assessment of mood in relation to drinking and provide a snapshot of social engagement across the day and in relation to drinking. EMA could also be used to collect information on the mood of others in the situation; although, recent research indicates self-reported PANAS scores do not spread throughout social networks (Greetham, Hurling, Osborne, & Linley, 2011). Assessment of mood was also limited by the timing of the end-of-day assessment in this study. Specifically, 67% of mood ratings on drinking days were provided after alcohol consumption had been initiated, while 33% of mood ratings were provided prior to alcohol consumption, and it is unknown how alcohol may have altered their mood rating if it were collected later. Related to this, though the social and drinking measures and multilevel modeling analyses identify statistically significant associations when accounting for covariates, these relationships should not be interpreted as causal.

4.4 Future Directions

Drinking is associated with positive mood, but only in the short term. Students may be more likely to engage in alcohol-related activities that provide immediate reinforcement (e.g., reduce anxiety, produce euphoria), which places them at risk for greater negative consequences (Murphy et al., 2007). To date, the majority of research has shown that negative mood states predict drinking problems. Negative affect has been shown to strengthen the relationship between alcohol use and alcohol use problems among college students (Martens et al., 2008), and negative mood predicts more drinking-related consequences (Wardell, Read, & Colder, 2013). Consistent with the present findings indicating that students who drank reported lower ratings of next-day positive mood, future studies should examine whether drinking consequences and mood covary to influence drinking expectancies and drinking behavior. This would further contextualize research finding shorter sadness-to-next-day-drinking intervals among those with lower drinking consequences (Hussong, 2007). Moreover, future research may benefit from assessing drinking motives, as associations between drinking and mood among those who endorse drinking to cope with negative affect may differ from patterns found in the present study.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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Table 1.

Multilevel model coefficients for the association between daily mood and same-day drinking, same-day social context, and covariates.

	Positive Mood			Negative Mood		
	b	95% CI	p-value	b	95% CI	p-value
Intercept	4.769	4.427, 5.111	<0.001	4.167	3.746, 4.588	<0.001
Same Day Drinking	0.258	0.200, 0.315	<0.001	-0.282	-0.348, -0.215	<0.001
% of Drinking Days	0.004	-0.038, 0.045	0.860	-0.070	-0.120, -0.02	0.006
Same Day Social	0.363	0.300, 0.427	<0.001	-0.303	-0.384, -0.223	<0.001
% of Social Days	0.011	-0.032, 0.055	0.608	-0.024	-0.077, 0.029	0.373
Day of the week						
Sunday (ref)						
Monday	-0.04	-0.115, 0.035	0.297	0.137	0.050, 0.223	0.002
Tuesday	-0.084	-0.159, -0.009	0.029	0.220	0.133, 0.306	<0.001
Wednesday	-0.012	-0.088, 0.064	0.759	0.190	0.103, 0.277	<0.001
Thursday	0.023	-0.053, 0.099	0.555	0.181	0.093, 0.268	<0.001
Friday	0.088	0.010, 0.166	0.027	0.057	-0.032, 0.147	0.210
Saturday	0.177	0.100, 0.253	<0.001	-0.173	-0.261, -0.086	<0.001
Female	-0.107	-0.247, 0.034	0.138	0.175	0.004, 0.346	0.046
Fraternity/Sorority	-0.119	-0.266, 0.027	0.112	0.225	0.047, 0.403	0.014
Positive mood	0.225	0.153, 0.297	<0.001	-0.178	-0.265, -0.090	<0.001
Negative mood	-0.101	-0.173, -0.03	0.006	0.285	0.198, 0.372	<0.001

Table 2.

Multilevel model coefficients for the association between daily mood and prior- and same-day drinking, prior- and same-day social context, and covariates.

	Positive Mood			Negative Mood		
	b	95% CI	p-value	b	95% CI	p-value
(Intercept)	4.796	4.45, 5.141	<0.001	4.16	3.74, 4.579	<0.001
Prior day drinking	−0.076	−0.133, −0.02	0.009	−0.041	−0.107, 0.025	0.227
Same day drinking	0.256	0.195, 0.318	<0.001	−0.275	−0.344, −0.207	<0.001
% drinking days	0.014	−0.028, 0.056	0.518	−0.069	−0.119, −0.019	0.007
Prior day social	0.011	−0.053, 0.075	0.735	−0.09	−0.164, −0.017	0.016
Same day social	0.356	0.288, 0.424	<0.001	−0.268	−0.352, −0.183	<0.001
% social days	0.009	−0.036, 0.053	0.705	−0.014	−0.067, 0.039	0.601
Day of the week						
Sunday (ref)						
Monday	−0.066	−0.145, 0.014	0.106	0.099	0.008, 0.191	0.033
Tuesday	−0.089	−0.169, −0.009	0.029	0.189	0.097, 0.281	<0.001
Wednesday	−0.008	−0.088, 0.071	0.839	0.161	0.069, 0.252	0.001
Thursday	0.02	−0.06, 0.101	0.618	0.133	0.041, 0.225	0.005
Friday	0.082	0.001, 0.163	0.046	0.016	−0.077, 0.109	0.733
Saturday	0.192	0.112, 0.271	<0.001	−0.182	−0.273, −0.09	<0.001
Female	−0.119	−0.26, 0.023	0.102	0.179	0.011, 0.346	0.038
Fraternity/Sorority	−0.124	−0.272, 0.023	0.099	0.216	0.041, 0.39	0.016
Positive mood	0.222	0.15, 0.294	<0.001	−0.176	−0.261, −0.09	<0.001
Negative mood	−0.108	−0.179, −0.036	0.003	0.299	0.214, 0.384	<0.001