

RUNNING HEAD: Smoking Status and BrAC

Title: Examining differences in breath alcohol concentration (BrAC) levels and hazardous drinking by smoking status among a sample of college student bar patrons

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Abstract

Background/Objectives: While the association between current smoking and alcohol consumption is well known, the relationship between social smoking and alcohol consumption is less understood. The purpose of this study was to examine the association between smoking status and two alcohol consumption measures in a sample of college student bar patrons.

Methods: The data used in this study was collected in the fall 2015. Study participants (N = 415) were college student bar patrons who agreed to complete an interview that assessed smoking status (i.e., regular smoker, social smoker, non-smoker) and two alcohol consumption measures: (1) breath alcohol concentration (BrAC) levels (using a handheld breathalyzer device) and (2) hazardous drinking scores (using the AUDIT-C scale). We conducted one-way ANOVAs with Bonferroni correction to examine differences in BrAC levels and hazardous drinking scores by smoking status.

Results: Among sample participants, 25.3% were regular smokers, 14.7% were social smokers, and 60.0% were non-smokers. Smokers had significantly higher BrAC levels than social smokers and non-smokers. Regular smokers also had significantly higher hazardous drinking scores than social smokers and non-smokers. The BrAC levels and hazardous drinking scores of social smokers and non-smokers were not significantly different.

Discussion and Conclusions: The drinking habits of social smokers reflected those of non-smokers and being a regular smoker was associated with higher drinking levels than the rest of the sample. Because of the association found between alcohol consumption and regular smoking, combining efforts to reduce these behaviors in college students might be advantageous.

Key words: smoking, BrAC, alcohol field study, college students, hazardous drinking

Introduction

Research has consistently found positive relationships between smoking and alcohol consumption (U.S. Department of Health and Human Services & National Institute on Alcohol Abuse and Alcoholism, 2007). The 2013 National Survey on Drug Use and Health indicated that smokers were more likely to drink in the past 30 days than non-smokers (65.2% smokers, 48.7% non-smokers), binge drink in the past 30 days (five or more drinks on the same occasion; 42.9% vs. 17.5%), and drink heavily in the past 30 days (binge drinking five or more days; 15.7% vs. 3.8%) (Centers for Disease Control and Prevention, 2017). Further, individuals dependent on alcohol are three times more likely (than the general population) to be smokers and those dependent on tobacco are four times more likely to be dependent on alcohol (Grant, Hasin, Chou, Stinson, & Dawson, 2004). Research examining alcohol use and smoking among college students found that smokers were more likely to binge drink, be classified as hazardous drinkers, and meet the DSM-IV diagnoses of alcohol dependence and abuse (Harrison, Desai, & McKee, 2008).

Social smoking is a form of smoking when an individual may smoke on some days but not every day and primarily smoke in social situations with their peers (Schane, Glantz, & Ling, 2009). Individuals who participate in social smoking are often called intermittent smokers (ITS) (Shiffman et al., 2014). The rates of social smoking have been investigated in college students, where more than half of smokers were classified as social smokers (Levinson et al., 2007; Moran, Wechsler, & Rigotti, 2004; Waters, Harris, Hall, Nazir, & Waigandt, 2006). Furthermore, research has indicated that social smoking in the young adult years can sometimes lead to the progression of the behavior, due to repeated exposure, and result in regular smoking (Shiffman et al., 2014). However, the pattern of social smoking does not support the established

RUNNING HEAD: Smoking Status and BrAC

patterns of nicotine dependence/maintenance of a regular smoker, and therefore, smoking motives, such as alcohol exposure, have been assessed as potential triggers for ITS (Conklin, Robin, Perkins, Salkeld, & McClernon, 2008). Specifically, there have been examinations of smoking and alcohol consumption in field study settings with young adult bar patrons, which have found higher smoking rates than seen in the general population and have found that increased drinking and binge drinking increased the probability of smoking (Jiang, Lee, & Ling, 2014a; Jiang & Ling, 2013).

While the association between current smoking and alcohol consumption is well known, the relationship between social smoking (smoking that only occurs in social settings) and alcohol consumption is less understood. The purpose of this study was to examine the association between smoking status and two alcohol consumption measures in a sample of college student bar patrons. This study extends previous field study research on smoking and alcohol consumption (Guillory, Lisha, Lee, & Ling, 2017; Jiang et al., 2014a; Jiang, Lee, & Ling, 2014b; Jiang & Ling, 2013) by using an objective measure of current alcohol intoxication – breath alcohol concentration (BrAC) levels – to examine associations between smoking status and alcohol consumption. This allows us to better understand alcohol use in relation to smoking status and can inform future efforts to identify college students at risk of substance abuse disorders. Because the associations found between smoking and alcohol consumption in previous studies, we hypothesize that smokers (regular and social smokers) in our study will evidence higher BrAC levels and hazardous drinking scores than non-smokers.

Methods

Study procedure

RUNNING HEAD: Smoking Status and BrAC

This study was approved by the University's Institutional Review Board. To collect our data, we conducted two field studies in a college community's bar and restaurant district, which includes 12-15 bar establishments. Patrons of the district are primarily students attending two public institutions of higher education: a medium-sized university and a two-year college. The only exclusion criterion was being less than 18 years old. Both college students and non-students participated in the study (n=565). We removed from analysis 31 participants because their survey responses were incomplete and 119 participants because they were not college students. For our analyses, we thus examined the sub-sample of 415 college students.

Data were collected by teams of trained undergraduate and graduate students; 6-8 teams of students collected data, and each team consisted of 5-7 students. Student training included completion of an online protection of human subjects training and a classroom training concerning study protocol and using the handheld breath-testing device (Alco-Sensor IV, Intoximeter, Inc., St Louis, MO). The study was conducted on two Friday nights in September 2015 between 11:00 pm and 2:00 am. In order to recruit participants, data collection teams circulated throughout the bar and restaurant district to various areas where patron traffic was heavy. The data collectors obtained informed consent from participants. After participant consent was obtained, an interviewer conducted a face-to-face interview using a structured interview form, which included the measures described in detail below.

After the brief interview was completed, participants provided a BrAC sample using a handheld breath-testing device. Consistent with procedures outlined by other researchers (Barry, Chaney, & Stollefson, 2013; Thombs et al., 2009) participants were provided only their BrAC range using a stoplight graphic which illustrated specific BrAC categories: *Danger/Red Light* (0.08 and above), *Caution/Yellow Light* (0.02-0.07), and *Safer/Green Light* (less than 0.02).

RUNNING HEAD: Smoking Status and BrAC

After participants finished the interview, they received “walk-away” cards with information about resources for alcohol-related problems, contact information concerning safe transportation, bottled water, and a snack (hotdog).

Measures

Smoking status

Smoking status was assessed via two questions: (1) Have you smoked 100 cigarettes in your lifetime? (yes/no), which is a standard measure in the field of tobacco control (Bondy, Victor, & Diemert, 2009), and (2) In the past 30 days, have you smoked mainly when you are: (with people/when you are alone/both/not a smoker) (Moran et al., 2004). Using these questions, we created three smoking groups: non-smokers, social smokers, and smokers. Participants who classified as social smokers were those who smoked fewer than 100 cigarettes but indicated that they smoked in the past 30 days either with people or both (with people and alone).

BrAC levels

We collected BrAC samples using handheld breath alcohol testing instruments (Alco-Sensor IV, Intoximeter, Inc., St Louis, MO). To reduce potential inflation of BrAC readings, participants who had consumed alcohol within the previous eight minutes were provided with a 3-ounce cup of water to rinse the mouth of residual alcohol before measuring and recording the BrAC sample.

Hazardous drinking score

To assess hazardous drinking, we used the Alcohol Use Disorders Identification Test-Consumption (AUDIT-C) screen, which is a brief version of the AUDIT (Saunders, Aasland, Barbot, de la Fuente, & Grant, 1993). The AUDIT-C includes the first three consumption items from the AUDIT and has been developed and tested for effectiveness in detecting hazardous

RUNNING HEAD: Smoking Status and BrAC

drinking behaviors (Bradley et al., 2007; Bush, Kivlahan, McDonnell, Fihn, & Bradley, 1998). In addition, the AUDIT-C has sound psychometric qualities and demonstrates equivalent levels of accuracy compared to the 10-item AUDIT instrument (Bradley et al., 2003; Reinert & Allen, 2007). The three AUDIT-C items measure frequency of drinking alcohol (“*How often do you have a drink containing alcohol?*”), drinking quantity (“*How many standard drinks containing alcohol do you have on a typical day?*”), and heavy episodic drinking (“*How often do you have six or more drinks on one occasion?*”). Each item has five response options, and options are coded 0-4 (Bush et al., 1998). Hazardous drinking was treated as a continuous variable (Range = 0-12) and a higher score corresponded with more hazardous drinking.

Demographics

In addition to assessing smoking status and alcohol-related behaviors, we assessed age, gender, race/ethnicity, college student status, and Greek affiliation. Because we aimed to assess drinking behaviors, we dichotomized the age variable by legal drinking status: (1) those less than 21 and (2) those 21 or older.

Data analysis

Data were analyzed using the Statistical Package for the Social Sciences (SPSS version 22). To assess sample characteristics, basic descriptive statistics were calculated and hazardous drinking scores (using the AUDIT-C) were summed. Next, we calculated smoking status rates among participants by demographic characteristics (i.e., gender, race, age, class status, Greek affiliation). Finally, we conducted one-way ANOVAs with Bonferroni correction to examine differences in BrAC levels and hazardous drinking scores by smoking status.

Results

RUNNING HEAD: Smoking Status and BrAC

The average age of participants was 20.8 (SD = 2.4, Range = 18-37) and 58.8% were male. The racial breakdown of the sample is as follows: Non-Hispanic White (69.9%), African-American (15.9%), Hispanic (5.8%), other (3.9%), American Indian (1.7%), Asian/Pacific Islander (1.4%), and multi-racial (1.4%). The class status of the sample is as follows: Freshman (24.3%), sophomore (17.3%), junior (22.4%), senior (31.1%), graduate student (4.8%). The majority of the sample (78.1%) were not affiliated with Greek organization. The average BrAC level was .068 (SD = .055; Range = .000 - .237) and the average hazardous drinking score was 4.7 (SD = 2.5; Range = 0-12). Among sample participants, 25.3% (n = 105) were regular smokers, 14.7% (n = 61) were social smokers, and 60.0% (n = 249) were non-smokers. Comparisons of demographic variables (gender, race, age, class status, Greek affiliation) by smoking status are listed in Table 1.

Table 1 here

Next, we conducted one-way ANOVA tests with Bonferroni correction to examine differences in smoking status by BrAC level and hazardous drinking scores (see Table 2). Smokers had significantly higher hazardous drinking scores (Mean = 5.7) than social smokers (Mean = 4.4) and non-smokers (Mean = 4.3). Smokers also had significantly higher BrAC levels (Mean = 0.088) than social smokers (Mean = 0.059) and non-smokers (Mean = 0.063). The BrAC levels and hazardous drinking scores of social smokers and non-smokers were not significantly different.

Table 2 here

Discussion

A strength of our study is that we examined the ability of two different measures of alcohol consumption to predict smoking status: a self-report measure (hazardous drinking based on AUDIT-C scores) and an objective measure (BrAC levels). Contrary to our hypothesis, the drinking habits of social smokers reflected those of non-smokers. However, consistent with our hypothesis, being a regular smoker was associated with higher levels of alcohol consumption. This finding is in line with prior research which indicated that college student smokers were more likely to engage in risky drinking behavior, including binge drinking and hazardous drinking (Harrison et al., 2008), and experience drinking problems (Weitzman & Chen, 2005). Concerning demographics, males evidenced higher rates of smoking (33.6% for males vs. 13.5% for females), which is consistent with the findings in other studies among college students (Harrison et al., 2008) and field studies among college students (Guillory et al., 2017; Jiang & Ling, 2013).

Limitations

A limitation of this study is the use of cross-sectional design that does not allow the detection of causal relationships. Further, this study is limited by the use of a convenience sample from one bar district serving two universities in the southeastern US. Thus, the findings might not necessarily be representative of other samples of bar patrons and/or college students. In addition, because the data were collected on two specific nights in the fall, the findings might not be representative of drinking behaviors on other nights and during other times of the year. Due to the self-selection of the participant pool, and self-reported data from intoxicated individuals, there is room for potential selection bias or response bias. Aside from intoxication

RUNNING HEAD: Smoking Status and BrAC

levels, the survey took place face-to-face in a public area, where participants were surrounded by peers; this may also hinder some of the answers to questions asked. We were limited by our smoking measures and might not have adequately assessed social smoking. Future examinations of smoking and alcohol consumption should consider a more detailed assessment of smoking behaviors, including more open-ended research questions that offer more explanation of participants' range in smoking behaviors. Findings from this study may bring about new potential research questions, but may be difficult to generalize beyond the study population.

Conclusion

The relationships between smoking status and alcohol consumption, among college students specifically, are not well-understood. In this analysis, the drinking habits of social smokers reflected those of non-smokers and being a regular smoker was associated with higher drinking levels than the rest of the sample. Because of the association found between alcohol consumption and regular smoking, combining efforts to reduce these behaviors in college students might be advantageous. Further research on varying levels of social smoking and the association with drinking behaviors (e.g., non-drinkers, occasionally drinking, binge drinking, hazardous drinking) could be expanded to support any co-occurrence of the two behaviors. Interventions targeting co-substance use in college students and health implications of those behaviors would be beneficial.

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RUNNING HEAD: Smoking Status and BrAC

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