



Alcohol mixed with energy drinks are robustly associated with patterns of problematic alcohol consumption among young adult college students



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HIGHLIGHTS

- Alcohol mixed with energy drinks (AmEDs) are related to alcohol dependence.
- Consumers of AmEDs are not higher in sensation seeking than alcohol only consumers.
- AmED use robustly predicts alcohol dependence over sensation seeking and impulsivity.

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ABSTRACT

Background: Young adults are a population at great risk for problematic health behaviors. Alcohol mixed with energy drink (AmED) consumption is a relatively popular health risk behavior among young adults. AmED consumption continues to illustrate negative outcomes in the research literature, having been linked with other substance use, high-risk sexual behavior, and sexual victimization. Limited research to date has examined associations between AmED consumption and patterns of alcohol dependence.

Methods: Undergraduate college students ($n = 757$) filled out an online survey which assessed their drinking habits in the past week and month, including their consumption of AmED beverages, personality characteristics, substance use, and problematic alcohol consumption via the Alcohol Use Disorders Identification Test (AUDIT). **Results:** A minority of participants reported AmED consumption in both the past month (11.6%) and past week (9.7%). Compared to their alcohol-only drinking counterparts, AmED consumers scored significantly higher on measures of impulsivity, and lower on anxiety sensitivity when compared to their alcohol-only drinking counterparts. In multivariate analyses, AmED consumption was robustly associated with patterns of alcohol dependence (AUDIT score ≥ 8) among young adult college students, while controlling for energy drink use, alcohol use, personality factors, substance use, and demographic variables.

Conclusions: AmED consumption in the past month is robustly associated with problematic alcohol consumption. The present study describes harmful outcomes associated with AmED consumption, and extends the literature on the combined effects of alcohol and energy drinks on young adult risk behaviors. Further research needs to address causal mechanisms for the AmED and problematic alcohol consumption relation.

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1. Introduction

Energy drinks are highly caffeinated beverages marketed to increase energy, stamina, and wakefulness. Energy drinks are commonly marketed to young adults (Heckman, Sherry, Mejia, & Gonzalez, 2010), which may contribute to greater normativity for consumption. Alcohol mixed with energy drinks (AmED) has become a relatively common trend in alcohol consumption behavior among college students, and research suggests that between 24 and 40% of college students report past month consumption (Arria & O'Brien, 2011; Arria et al., 2011; Brache & Stockwell, 2011;

Velasquez, Poulos, Latimer, & Pasch, 2012; Snipes & Benotsch, 2013). These drinks gained significant media attention when the FDA issued a letter to manufacturers of AmED beverages that caffeine was not a “generally recognized as safe” additive to alcoholic beverages, requesting the removal of caffeine from their alcohol products (FDA, 2010). This decision was predicated on numerous studies, which have linked AmED consumption with negative outcomes.

1.1. AmED and risk outcomes

Consumption of AmED beverages has been shown to be relatively risky in terms of health behaviors, having been linked to engaging in high-risk and casual sex (Snipes & Benotsch, 2013; Miller, 2012), intending to drive after drinking (Thombs et al., 2010), and being taken

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advantage of sexually (O'Brien, Arria, Howland, James, & Marczynski, 2011; Snipes, Green, Javier, Perrin, & Benotsch, 2014). Consuming AmED has been shown to make an individual more likely to underestimate their impairment from alcohol, consume a greater number of alcoholic drinks, and drink to higher blood alcohol concentrations than alcohol-only drinkers (Ferreira, de Mello, Pompeia, & de Souza-Formigoni, 2006; O'Brien, McCoy, Rhodes, Wagoner, & Wolfson, 2008; Thombs et al., 2010).

1.2. AmED and patterns of alcohol dependence

AmED consumption may also be a risk factor for a pattern of alcohol dependence. Consuming AmED beverages has been shown to increase the desire for more alcohol, more so than alcohol-only beverages (Marczynski, Fillmore, Henges, Ramsey, & Young, 2013). Some indirect research on AmED and high-risk drinking has generally supported a relation between AmED consumption and patterns of alcohol dependence. For example, research has shown associations between AmED consumption and binge drinking and other high-risk drinking behaviors (Brache & Stockwell, 2011; O'Brien et al., 2008; Woolsey, Waigandt, & Beck, 2010). However, examinations of specific patterns of alcohol dependence are generally lacking.

A study examining work place drinking investigated the role of AmED consumption in alcohol dependence among the Taiwanese working population (Cheng, Cheng, Huang, & Chiou-Jong, 2012). While AmED consumption was not a primary focus in their study, they found that patterns of alcohol dependence (defined as ≥ 2 on the CAGE questionnaire) had a high prevalence (38.7% for men, 23.3% for women) among those who reported consuming AmED beverages (Cheng et al., 2012). While no other information (including significance tests) was provided in their study, it provides an impetus for suggesting that there may be a connection between AmED consumption and patterns of alcohol dependence. A more recent study by Lau-Barraco, Milletich, and Linden (2013) examined caffeinated alcoholic beverages (CABs) and alcohol severity (defined by Alcohol Use Disorders Identification Test [AUDIT] scores greater than 8). Lau-Barraco et al. (2013) divided participants into low/high groups in terms of alcohol use and CAB use. Their analysis found that high CAB/high alcohol consumers had significantly higher AUDIT scores than their low alcohol/low CAB group. However, measuring CAB instead of AmED drinking behavior is a more liberal estimate of a different type of drinking behavior. CAB beverages may, or may not, include energy drinks, which is critical as energy drinks may contain greater amounts of caffeine than most caffeinated sodas, as well as additional ingredients such as taurine, which has been shown to interact with alcohol (Olive, 2002). Additionally, their analysis was focused on examining different groups of alcohol consumers (high CAB/high alcohol consumers vs. high alcohol/low CAB consumers), and not identifying risk factors for patterns of alcohol dependence.

1.3. Methodological problems and controversy

It is worth noting the occasions when AmED beverages do not show detrimental associations. In mostly international studies, there has been evidence that AmED beverages do not reduce subjective effects of intoxication or greatly increase risk propensity (Peacock, Bruno, & Martin, 2012; Peacock, Bruno, Martin, & Carr, 2013). Some of the research linking energy drinks and negative alcohol-related outcomes (e.g., Marczynski et al., 2013) has come under criticism as being relatively meaningless when examining real-world outcomes (Peacock & Bruno, 2013). For example, as Peacock and Bruno note, while Marczynski et al.'s (2013) study shows that AmED consumption primes users to desire more alcohol, the strength of the desire (e.g., 28 on a scale from 0 [the absence of desire] to 100 [very much desire]) may not cause any meaningful change in drinking choices in the real world. Thus, research is needed on both AmED priming and actual subsequent alcohol intake.

Peacock and Bruno (2013) argue that some of the variance in the relation between AmED and harmful outcomes may be related to demographic factors, such as the finding that young men who are more likely to drink AmED may also tend to take more risks. Peacock and Bruno (2013) also comment that studies controlling for important extraneous variables, such as sensation seeking, are absent. Research should attempt to control for factors that may be consistent with high-risk drinking (e.g., impulsivity, sensation seeking, race, gender), especially in cross-sectional studies. Thus, Peacock and Bruno (2013) make a viable and testable critique of studies examining links between AmED consumption and risk outcomes when they state that sensation seeking should be controlled for when examining AmED use. Sensation seeking may in fact be an important variable to assess when examining AmED consumption. Zuckerman (2007) stated that personality traits, like sensation seeking, might encourage individuals to participate in a wide array of risk behaviors, including high-risk drinking. While this makes conceptual sense, the evidence for sensation seeking explaining relations between AmED and risk outcomes is lacking. From the few examples that can be found in the literature, there is more evidence that relations between AmED consumption and negative outcomes are not confounded by sensation seeking or risk taking propensity. Arria et al. (2011) showed that links between energy drinks and alcohol dependence were significant, even after controlling for impulsive sensation seeking, conduct problems, and a history of alcohol and drug abuse. Moreover, Brache and Stockwell (2011) found that AmED consumption was associated with a range of high-risk drinking behaviors, a finding that remained significant after controlling for risk taking propensity.

There has been limited study of AmED beverages and their relation to constructs such as patterns of alcohol dependence. However, there is a clear need for such evidence in light of the past research which shows clear associations between AmED consumption and high-risk drinking behavior (O'Brien et al., 2008). The goals of the present study were to describe associations among AmED consumption and patterns of alcohol dependence in a sample of young adult college students. Our analysis aimed to measure potentially confounding personality constructs thought to be associated with risk behavior (e.g., sensation seeking, impulsivity), and use those variables as statistical controls.

2. Method

Data were collected from a subject pool of 757 undergraduate college students ages 18–25 at a mid-Atlantic university. Participants were students in psychology course and received course credit for their participation. Surveys were not completed during class hours; participants were free to fill out their survey in their free time online at any time before the end of the semester. Participants were free to select our survey from a list of other online studies being performed, based on a brief description of the purpose of each study. Participants were unaware of the main goal of the study. They were given an alternative assignment if they did not wish to participate. Approval was obtained for this study through the university's institutional review board.

2.1. Measures

2.1.1. Demographics

Participants were asked to report their age, gender, race/ethnicity, sexual orientation, and relationship status.

2.1.2. Substance use

Participants were asked a series of questions about their use of the following substances in the past 3 months: energy drinks, marijuana, ecstasy, methamphetamine, cocaine, ketamine, and "poppers" (amyl or butyl nitrate). Responses were scored on a Likert-type continuum ranging from 1 (*none*) to 4 (*at least every week*). Measures similar to these have shown utility in previous research (Benotsch, Snipes, Martin, & Bull, 2013).

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