



Energy Drink Consumption and the Risk of Alcohol Use Disorder among a National Sample of Adolescents and Young Adults

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Objective To assess the association between energy drink use and hazardous alcohol use among a national sample of adolescents and young adults.

Study design Cross-sectional analysis of 3342 youth aged 15-23 years recruited for a national survey about media and alcohol use. Energy drink use was defined as recent use or ever mixed-use with alcohol. Outcomes were ever alcohol use and 3 hazardous alcohol use outcomes measured with the Alcohol Use Disorders Identification Test (AUDIT): ever consuming 6 or more drinks at once (6+ binge drinking) and clinical criteria for hazardous alcohol use as defined for adults (8+AUDIT) and for adolescents (4+AUDIT).

Results Among 15-17 year olds (n = 1508), 13.3% recently consumed an energy drink, 9.7% ever consumed an energy drink mixed with alcohol, and 47.1% ever drank alcohol. Recent energy drink use predicted ever alcohol use among 15-17-year-olds only (OR 2.58; 95% CI 1.77-3.77). Of these 15-17-year-olds, 17% met the 6+ binge drinking criteria, 7.2% met the 8+AUDIT criteria, and 16.0% met the 4+AUDIT criteria. Rates of energy drink use and all alcohol use outcomes increased with age. Ever mixed-use with alcohol predicted 6+ binge drinking (OR 4.69; 95% CI 3.70-5.94), 8+AUDIT (OR 3.25; 95% CI 2.51-4.21), and 4+AUDIT (OR 4.15; 95% CI 3.27-5.25) criteria in adjusted models among all participants, with no evidence of modification by age.

Conclusions Positive associations between energy drink use and hazardous alcohol use behaviors are not limited to youth in college settings. (*J Pediatr* 2014;165:1194-200).

Underage drinking is a major public health problem in the US.¹ More than 27% of 12- to 20-year-olds drink alcohol in any month, averaging 4.9 drinks per session.² Binge drinking increases the risk of acute and chronic alcohol-related problems¹ including injury, risky sexual behaviors, and driving while intoxicated.¹ Those who begin drinking alcohol before the age of 18 are more likely to develop symptoms of alcohol abuse and dependence as an adult than their peers who abstain,^{3,4} associations that are largely mediated by increased rates of binge drinking.^{3,5} In 2007, the US Surgeon General's Office issued a Call to Action to reduce underage drinking.¹ However, emergency room visits for alcohol-related injuries among 12- to 20-year-olds have been steady since 2007, with estimates from 2009 documenting nearly 200 000 visits.⁶

Energy drinks are caffeinated beverages, shots, or drops that contain a mix of other energy promoting ingredients (eg, taurine, ginseng, guarana, B-vitamins) and frequently sugar. Caffeine contents of popular energy drinks range from 70 mg per one 8-ounce serving to 200 mg per one 16-ounce serving⁷; concentrations similar to that of a strong cup of coffee. Energy drinks are becoming increasingly popular among US adolescents.⁸⁻¹³ The American Academy of Pediatrics discourages adolescents from consuming energy drinks stating such drinks have no therapeutic benefits.¹⁴ Even as some have criticized those calls as scaremongering,¹⁵ energy drink use among adolescents deserves attention given the common practice of mixing energy drinks with alcohol among young adults.^{16,17}

Many college students consume energy drinks mixed with alcohol¹⁸⁻³¹ often with the intent to consume excessive amounts of alcohol during 1 session.^{21,24} Energy drinks consumed with alcohol result in the user feeling less intoxicated,^{25,32,33} although they do not lessen alcohol's effects on objective measures of impairment.³²⁻³⁴ Consuming energy drinks with alcohol is positively associated with binge drinking and alcohol-related aggressive behaviors, risky sexual behaviors, and the need for medical attention among college students.¹⁸⁻²⁸ One study of adolescents reported a positive association between frequency of energy drink consumption and past 30-day alcohol use.¹⁰ Another study among adolescents reported a positive association between ever use of energy drinks mixed with alcohol and binge drinking or alcohol-related fights or injuries.¹²

We studied the prevalence of energy drink consumption among a national sample of US adolescents and young adults, and assessed whether energy drink consumption is associated with problematic alcohol use.

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AUDIT Alcohol Use Disorders Identification Test

Methods

Data are from a national cohort study that enrolled youth aged 15-23 years to assess media use, marketing exposures, and alcohol use.³⁵ Participants were recruited via a random-digit dialing protocol using both landline and cell phone numbers during 2010. Households with children aged 15-23 years were eligible for the study; 1 participant per household was selected for enrollment. Of the 60 189 households screened, 6783 included a family member in the target age range and 3342 (49.3%) agreed to complete the telephone survey. All US states and the District of Columbia were represented in the final sample. Participants completed a computer-assisted telephone interview conducted by trained study interviewers (Westat, Rockville, Maryland). Participants ≥ 18 years gave verbal consent; parental and adolescent assent were required for participants < 18 . Participants could enter responses to sensitive questions using the touch-tone keypad of their phone for privacy. The Committees for the Protection of Human Subjects at Dartmouth College and at Westat approved all study activities.

Assessment of Energy Drink Use

Recent energy drink use was assessed as: "During the past 7 days, how many times did you drink a can, bottle, or glass of an energy drink like Red Bull or Monster (0, 1 to 3 times in past 7 days, 4 to 6 times in past 7 days, 1 time per day, 2 times per day, 3 times per day, or 4 or more times per day)?" Participants were also asked about mixed-use of energy drinks with alcohol: "Have you ever consumed an energy drink with or after alcohol (yes, no, I don't drink energy drinks)?"

Alcohol Use Outcomes

Two alcohol use outcomes were included in this analysis: ever drinking alcohol and hazardous use of alcohol within the past year. Ever drinking alcohol was assessed as: "Have you ever had a whole drink of alcohol more than a sip or taste (yes, no)?" Participants who responded yes were further administered the Alcohol Use Disorders Identification Test (AUDIT),³⁶ a 10-item scale (total score ranges from 0-40) assessing 3 domains of alcohol use and abuse: hazardous alcohol use (eg, see 6+ binge drinking below), dependence symptoms (eg, How often during the last year have you found that you were not able to stop drinking once you had started?), and harmful alcohol use (eg, "Have you or someone else been injured as a result of your drinking?"). The AUDIT is a validated scale used worldwide to identify individuals with hazardous alcohol use patterns and is used to identify individuals at risk of alcohol use disorder.³⁷ In this current study, participants were asked to recall behaviors over the past year. One item included in the AUDIT assessed binge drinking (6+ binge drinking): "How often do you consume 6 or more drinks on one occasion (never, less than monthly, monthly, weekly, daily or almost daily)?" Responses were dichotomized as never vs ever. Several large surveys in the US including the Monitoring the Future

study³⁸ define binge drinking among adolescents as 5 or more drinks on one occasion, and even lower age- and sex-specific thresholds have been suggested based on estimated blood alcohol concentrations.³⁹ The use of 6 or more drinks as a binge-drinking criterion is thus conservative for an adolescent population.

The AUDIT total score was used to assess the risk of alcohol use disorder. A score of 8 or more is suggested for identifying hazardous drinking behaviors among adults,³⁷ and a score of 4 or more is suggested for identifying hazardous drinking behaviors among adolescents as young as 13.^{40,41} Both outcomes (8+AUDIT and 4+AUDIT, respectively) were used to assess hazardous alcohol use.

Additional Measures

Additional measures included demographic characteristics of the child (age, sex, race, ethnicity, and educational or employment status) and measures likely associated with both energy drink and alcohol use (number of friends who drink alcohol, frequency of parental/guardian consumption of alcohol). Sensation seeking was assessed with a 6-item sensation seeking score (eg, I would like to explore strange places: strongly agree, agree, disagree, strongly disagree, and don't know; Cronbach alpha = 0.72) based on the constructs of Zuckerman⁴² and Arnett.⁴³ Responses over the 6 items were combined into a single, scaled sensation seeking propensity score (range 1-4), where higher scores reflect greater propensity for sensation seeking behaviors. Previous work by our group has demonstrated that the sensation seeking propensity score has moderate predictive ability for 6+ binge drinking (area under the receiver operating characteristic curve 0.71).⁴⁴

Statistical Analyses

Bivariate analyses compared the frequency of energy drink use in the past 7 days and each of the 4 alcohol use outcomes by baseline characteristics. Multivariate logistic regression was used to fit each of the 4 alcohol use outcomes on energy drink use measures; models for the 3 hazardous alcohol use outcomes were limited to participants who reported ever drinking alcohol. Model covariates were those variables with bivariate-level of associations ($P < .10$) with recent energy drink use as well as correlates of alcohol use. Analyses were completed overall and stratified by age, specifically adolescents (15-17 years), underage young-adults (18-20 years), and young adults of legal drinking age (21-23 years). Statistical significance of interactions by age was assessed using likelihood ratio tests comparing 2 nested models with and without an age/energy drink interaction term. All analyses were completed with the R Language and Environment for Statistical Computing, v 3.0.1 (www.R-project.org).⁴⁵

Results

Among this sample of youth, most (45.1%) were 15-17 years old, 32.7% were 18-20 years old, and 22.1% were at least 21 years of age; 51% of the participants were male. Most participants

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