



An emerging adolescent health risk: Caffeinated energy drink consumption patterns among high school students



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ABSTRACT

Objective. To examine the prevalence, patterns, and correlates of energy drink use among adolescents, and determine whether more frequent use of energy drinks is associated with poorer health and behavioral outcomes.

Methods. Data were from a 2012 cross-sectional survey of 8210 students in grades 7, 9, 10 and 12 attending public schools in Atlantic Canada. Multinomial logistic regression analysis was used to examine correlates of energy drink use patterns, including substance use, sensation seeking, risk of depression, and socioeconomic status.

Results. Nearly two-thirds of survey respondents (62%) reported consuming energy drinks at least once in the previous year, with about 20% reporting use once or more per month. Sensation seeking, depression, and substance use were all higher among energy drink users relative to non-users, and in higher frequency users relative to lower frequency users.

Conclusions. The prevalence of energy drink consumption among high school students was high. The association of energy drinks with other potential negative health and behavioral outcomes suggests that use of these products may represent a marker for other activities that may negatively affect adolescent development, health and well-being.

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Introduction

There is a growing concern about the increased consumption of energy drinks – beverages that contain moderate to high concentrations of caffeine as well as taurine, herbal supplements, and sugar or sweeteners, particularly among youth and young adults (Babu et al., 2008; Pennington et al., 2010; Reissig et al., 2009). These beverages contain amounts of caffeine that are substantially higher than what is found in a standard cup of coffee (Arria and O'Brien, 2011; Reissig et al., 2009), but have been cleverly marketed to entice youth and young adults (Reissig et al., 2009). Sales of energy drinks in North America have increased substantially in recent years and are forecasted to approach \$20 billion in the U.S. by the end 2013 (Heckman et al., 2010). Although there is no information readily available about how much of this is attributable to youth, it is known that approximately 30 to 50% of adolescents and young adults report regularly consuming such drinks (O'Brien et al., 2008). The appeal of energy drinks to youthful drinkers stems from its temporary benefits of increased alertness and improved mood, and enhanced mental and physical energy (Arria and O'Brien,

2011; Babu et al., 2008; Oddy and O'Sullivan, 2009; Reissig et al., 2009; Seifert et al., 2011; Smith et al., 2004).

Excessive caffeine intake by adolescents has, however, been shown to produce a number of deleterious health effects, such as irritability, cardiovascular symptoms, sleep impairment, and feelings of nausea and nervousness (Iyadurai and Chung, 2007; Nordt et al., 2012; Orbeta et al., 2006; Savoca et al., 2005; Seifert et al., 2011; The American Academy of Pediatrics Committee on Nutrition, and Council on Sports Medicine and Fitness, 2011). A number of studies point to the increasing use of alcohol mixed with energy drinks, which is associated with a number of alcohol-related problems and complications in younger populations, including junior and senior high school students. These include an increased likelihood of alcohol dependence, higher rates of binge drinking, and an increase in the likelihood of alcohol-related accidents and injuries (Azagba et al., 2013; Howland and Rohsenow, 2013; Howland et al., 2011; Marczynski et al., 2011; O'Brien et al., 2008; Patrick and Maggs, in press).

Recent studies point out that a significant number of college students in North America and elsewhere consume energy drinks, and that consumption is typically higher in young males, those who partake in sports, as well as those involved in substance use, prescription drug use and violent conduct (Arria et al., 2010; Buxton and Hagan, 2012; Hoyte et al., 2013; Miller, 2008; Oteri et al., 2007; Velazquez et al., 2012). However, little is known about the prevalence of use of energy drinks, use patterns, and correlates of energy drink consumption

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among junior and senior high school students. Particularly important is an understanding of who consumes energy drinks, how much is consumed, and in what ways these drinks are used. Excessive use of energy drinks has been linked to recent deaths in the United States and Canada (Bailey, 2012; Edney, 2012; Meier, 2012). A more in-depth examination of energy drink consumption in this vulnerable population is therefore warranted. Drawing on a representative sample of junior and senior high school students from three provinces in Atlantic Canada, the main objective of this study is to estimate the prevalence and correlates of energy drink use. Correlates include variables that are generally associated with adolescent health such as socio-demographic indicators as well as measures of depression, sensation seeking, substance use, and educational outcomes. As an additional objective, consumption patterns are assessed to determine whether more frequent use of energy drinks is associated with poorer health and behavioral outcomes.

Methods

Participants

The present study is based on the 2012 Student Drug Use Survey in the Atlantic Provinces (SDUSAP). The SDUSAP is a cross-sectional survey of 9226 students in grades 7, 9, 10 and 12 attending public schools in the three Atlantic Provinces Nova Scotia, New Brunswick, and Newfoundland & Labrador (total population: 2,187,434). Public school students in both Anglophone and Francophone schools were included in the sample; excluded were private schools, schools on reserve, street-youth, school-leavers and students who were absent from school on the designated day of the survey. The sample design was a two-stage stratified cluster sample of randomly selected classes containing at least 20 students in each of the four surveyed grades within each health region in the three participating provinces. The sample allowed for approximately proportional representation of each province, within each region, within each grade; thereafter, the sample was allocated proportionately according to school size. All students who participated in the survey had parental consent. Two weeks in advance of administering the survey, an information package was sent home to parents describing the survey. Parental consent was obtained in one of two ways depending on the school board. Some school boards required active parental consent for their child to take part in the survey, where a signed consent form was to be returned to the school. Other school boards required passive parental consent, whereby parents contacted the school if they did not want their child to take part in the survey. Finally, all students who did participate in the survey also gave individual/personal consent. Ethics approval was granted by the Dalhousie University Health Sciences Research Ethics Board. Ninety percent of students present on the day the survey was administered participated in the SDUSAP. The Nova Scotia instrument was derived from the prototype provided in the Canadian guidelines for self-reported adolescent drug use surveys and the survey was validated prior to its initial use in 1996 (Poulin et al., 1993).

Dependent variable

Energy drink use: a categorical variable was created to represent the consumption of caffeinated energy drinks in the past year: 1) non-use of energy drinks in the past 12 months, 2) consumed energy drinks one or two times in the past 12 months, 3) consumed energy drinks three to eight times in the past 12 months, 4) consumed energy drinks once a month in the past 12 months, and 5) consumed energy drinks more than once a month in the past 12 months. This question draws on similar questions in other surveys of school and college youth (Attila and Çakir, 2011; Berger et al., 2011; Malinauskas et al., 2007; Miller, 2008).

Independent variables

Depression was measured using a 12 item version of the Centers for Epidemiological Studies Depression Scale (CES-D) (range, 0–36, Cronbach's alpha = 0.87) with a higher score indicating increased risk of depressive symptoms. Three categories of depressive symptoms were created using the total CES-D score: very elevated (total score 21 to 36), somewhat (total score 12 to 20) and minimal (total score 0 to 11) (Poulin et al., 2005). Example items included in the 12-item CES-D were "I felt like depressed", "I had trouble keeping my mind on what I was doing", "I had crying spells", and "I felt like lonely".

Sensation seeking was measured according to how students strongly agreed or disagreed with the following 4 statements (scale range, 4–16, Cronbach's

alpha = 0.83): "I like new and exciting experiences, even if I have to break the rules", "I prefer friends who are exciting and unpredictable", "I like to explore strange places", and "I like to do frightening things" (Stephenson et al., 2003).

Academic performance was measured according to the question, "So far in the school year, what is your average on all your courses at school?" We grouped the responses into four categories: 80% or above, 70% to 79%, unknown, and less than 70% (reference category).

Substance use was captured by three measures: cigarette, alcohol and marijuana use. Cigarette use represented those who reported smoking more than one cigarette in the past year. Alcohol use represented those that reported drinking other than 'just a sip' in the past year. Marijuana use represented those that reported using marijuana at least once in the past year. An indicator variable was created to represent use of any one of other illicit drugs (e.g. cocaine, MDMA/ecstasy, LSD, non-medical stimulants, non-medical tranquilizers, methamphetamine). These questions have been widely used in previous student surveys, including the preceding five iterations of the current survey (Poulin et al., 1993).

The analysis also controlled for socio-demographic variables including province of residence. Age was represented in continuous form (number of years). Gender was coded 1 for males and 0 for females. Parental (mother) education was categorized as post-secondary education, unknown, and less than post-secondary education (reference category). Due to sample size students' living arrangement was coded as living with both parents vs. not living with both parents.

Statistical analysis

Given the categorical nature of the dependent measure, a multinomial logistic regression analysis was used to examine the correlates of energy drink use patterns. The sample design of the SDUSAP including sample weights was used in the analysis to produce population estimates and adjust for unequal probabilities of selection. Excluded from the analysis were the responses ($n = 108$) of students who reported using a fictitious drug, which was included in the survey to detect students not responding in a trustworthy fashion. Of the total 9118 students, 76 values were missing for energy drink question, 206 for gender, 298 for sensation seeking, 305 for depression, 145 for marijuana, and 169 for parental education. After omitting missing values, the total sample used in the present study was 8210. We checked for multicollinearity using the variance inflation factor (VIF) and the results showed no multicollinearity problem. All analyses were carried out using Stata version 12.

Results

Table 1 provides descriptive statistics for the sample. The analysis included 8210 students, of whom 51.8% were female. Their average age was 15.2 years. Just over 62% of junior and senior high school students reported having used energy drinks at least once in the past 12 months. Approximately 20% consumed energy drinks once or more per month in the last year. The characteristics of respondents (Table 1) were similar between our analytic sample ($n = 8210$) and the total sample ($n = 9118$).

Adjusted odds ratios from the multinomial logistic regression analysis are shown in Tables 2 and 3. In Table 2, the base category was non-energy drink use in the past year while the base category in Table 3 was the consumption of energy drink one or two times in the past year. This approach allows for the comparison of use with non-use, as well as between higher frequency use and lower frequency use. Findings show consistent, statistically significant associations between measures of age, gender, sensation seeking, depressive symptoms, and substance use with energy drink consumption.

In terms of socio-demographic indicators, the likelihood of consuming energy drinks was higher for males relative to females, with an increased odds ratio at higher levels of consumption (three to eight times; odds ratios [OR] 1.23; once a month, OR 1.97; more than once a month, OR 3.26). Moreover, these differences persisted (Table 3) when comparing higher frequency of consumption with lower frequency (once per month vs. one or two times, OR 1.87; more than once per month vs. one or two times, OR 3.09). Age, conversely, was protective with a lower likelihood of consumption among older students. For

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