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Age of first use of energy beverages predicts future maximal consumption among naval pilot and flight officer candidates

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ABSTRACT

Background: Energy drinks are popular beverages that can have adverse long-term health effects when consumed by children and adolescents. This study sought to determine if the age of first energy drink use in a U.S. military population is predictive of the maximum number of energy drinks consumed during a single day and/or single occasion (operationally defined as a couple of hours; e.g., a night out, during studying or sport session).
Method: Student U.S. naval aviator and naval flight officers who reported past-year use of energy drinks (N = 239) were surveyed to determine various measures of energy drink consumption.
Results: Age of first consumption was predictive of the maximum number of energy drinks consumed during a single occasion within the past year. Within this sample, the age range between 13 and 16 years appeared to be a critical period with results indicating that people who began consuming energy drinks during this period were 4.88 times more likely to consume high quantities (four or more) of energy drinks during a single occasion when compared to those who started consuming energy drinks between the ages of 20–23. Likewise, persons who began to consume energy drinks between the ages of 13–16 are 2.48 times more likely to consume high quantities of energy drinks during a single occasion than those who started between the ages of 17–19. There was no difference between 17 and 19 year olds and 20–23 year olds. Age of first use was not correlated to daily average intake or daily maximal intake of energy drinks.
Conclusions: A lower age of first energy drink use suggests higher risk of single-occasion heavy episodic consumption in this military population. Researchers should further explore the relationship of early onset energy drink consumption and potential future health risks.

1. Introduction

Energy drinks have become quite popular with adolescents and young adults. Among youths ages 12–17, the 2011 YouthStyles survey found that 8.5% of respondents reported consuming energy drinks on a weekly basis (Kumar et al., 2014). Results from the Monitoring the Future study found that among the 22,000 U.S. secondary school students surveyed, 30% reported using energy drinks (Terry-McElrath et al., 2014). Azagba et al. (2014) found that 62% of their surveyed respondents reported using energy drinks at least once in the last year, with approximately 20% stating that they used energy drinks once or more in the past month.

While consumption frequency is concerning, another concern is the quantity consumed during a single occasion. Given that energy drinks are served cold, are sweet, and come enhanced with high levels of caffeine, energy drinks may pose a serious risk to consumers who drink these beverages akin to other soft drinks. Consuming multiple energy drinks over a short period as brief as only a few hours may cause caffeine intoxication resulting in heart palpitations, hypertension, nausea and vomiting, convulsions, psychosis, and in some rare cases, even death (Gunja & Brown, 2012; Trabulo, 2011; Winston et al., 2005). Research suggests that energy drinks pose a public health risk and may be linked to other substance use problems (Arria et al., 2011; Azagba, Langille, & Asbridge, 2014; Breda et al., 2014; Hamilton, Boak, Ilie, & Mann, 2013; Reissig et al., 2009; Terry-McElrath et al., 2014).

1.1. Energy drinks, caffeine, and herbal ingredients

Energy drinks are frequently marketed by highlighting potential health benefits of L-carnitine, taurine, and other herbal ingredients despite the lack of research on actual physiological benefits. Because

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of this lack of evidence and the potential risks of mixing various herbal ingredients, many countries have begun to restrict energy drink sales (Bradley, 2012). To date, the U.S. has not regulated energy drink production or sales despite growing concern among public health researchers and practitioners. Because of the potential health implications to consumers, researchers have called upon the U.S. Food and Drug Administration to regulate energy drinks with little success (Thorlton et al., 2014). While the consumption of various herbal ingredients in energy drinks are vague and relatively unstudied, the ingredient of caffeine has been studied extensively. While high levels of caffeine consumption are concerning to health researchers, it is the potential interactive or synergistic effects of caffeine and varying levels of herbal ingredients that are most concerning. The potential neurological effects from the mixing of ingredients such as ginseng, yohimbine HCL, and evodamine have been noted by Woolsey et al. (2014b).

Another issue of concern among public health professionals is the potential mislabeling of energy drink ingredients. Few have examined the actual amount of listed herbal ingredients; however, caffeine content has been examined. Because production and sales are unregulated in the U.S., caffeine content per serving of the available energy drink products ranges widely and is often not truly reflective of the labeled content amounts (Bailey, Saldanha, Gahche, & Dwyer, 2014; Consumer Reports, 2012). An examination of 27 different products indicated a wide range of caffeine concentration (6 mg to 242 mg) among energy drink products (Consumer Reports, 2012). Eleven of the studied products did not list caffeine level, while the actual caffeine level in five of the remaining sixteen products was 20% higher than the listed amount. This variation and uncertainty regarding energy drink products pose a risk to consumers who may not be informed on the actual ingredients being consumed.

1.2. Age of first use of energy drinks

Early-age consumption of drugs such as alcohol, tobacco, and marijuana has been studied extensively (Magid & Moreland, 2014). Findings consistently report that early onset of consumption increases future risk of various social, physical, and psychological health problems including illicit drug use, heavy alcohol use, and misuse of licit substances (Agley et al., 2015; Bergen-Cico & Lape, 2013; Falls et al., 2011; Liang & Chikritzhs, 2015; Magid & Moreland, 2014; Morean et al., 2014; Sullivan & Cosden, 2015). Additionally, early-age consumption of caffeine has been linked to increased risk of significant mental and behavioral health problems (Benko et al., 2011; Martin et al., 2008; Temple, 2009). What remains relatively unstudied is early consumption of energy drinks.

Two studies have documented a mean age of first use of 16 years; however, these researchers did not explore this variable as it relates to other behaviors (Alsunni & Badar, 2011; Ibrahim et al., 2014). In a study of 144 youth, Miyake and Marmorstein (2015) suggested that early adolescent use of energy drinks may increase risk of later alcohol use. As consumption of energy drinks continues to increase among adolescents and young adults, age of first use should be explored. Of particular concern is whether or not early onset of energy drink use may lead to increased future use of energy drinks.

1.3. Energy drink use among military populations

The majority of studies examining energy drink consumption focus on general college students; however, few studies explore military personnel. Schmidt et al. (2008) examined energy drink consumption among a U.S. Air Force sample and found that consumption prevalence was higher among military personnel than the comparable general population, despite lower consumption frequency. Also noted was the high availability of energy drinks on Air Force work installations and bases. Toblin, Clarke-Walper, Kok, Sipos, and Thomas (2012) indicated that 45% of deployed military service members (U.S. Army and Marine combat platoons deployed to Afghanistan) reported daily energy drink use which is considerably higher than the civilian population (6%). Of these service members, 14% consumed three or more energy drinks per day. Another study examining active duty military personnel (Army, Navy, Air Force, Marine Corps, Coast Guard, Uniformed Public Health Service) reported that lower ranked military members were more likely to consume multiple energy drinks per day and more likely to think that energy drinks use was safe (Stephens, 2013). High military consumption rate may be linked to commonly self-reported side effects including increased pulse, restlessness, and inadequate sleep (Stephens et al., 2014; Toblin et al., 2012). The present study sought to examine energy drink consumption among military personnel, specifically to determine if age of first energy drink use is predictive of the maximum number of energy drinks consumed during a single day and/or single occasion. This allowed for exploration to determine if age at first use of energy drinks is a significant predictor of high rates of future energy drink consumption. For this study, "single occasion" was operationally defined as a couple of hours; e.g., a night out, during studying or sport session.

2. Methods

Human subjects approval was granted by the Navy Medical Operational Training Center Scientific and Ethical Review Committee and the IRB at the Naval Medical Research Unit — Dayton. An anonymous nutritional survey was presented to 302 student naval aviators and student naval flight officers undergoing Aviation Preflight Indoctrination training at a United States Navy base in Florida. Prior to the presentation of the survey, students were verbally informed as a group that an opportunity exists to participate in a study being conducted by Naval Aerospace Medical Institute (NAMI) researchers on energy drink consumption patterns. To minimize the possibility of coercion or undue influence, unit commanders were not present at the time of recruitment. Further, students were informed that their participation was voluntary, that there would be no penalty for not participating or for leaving the study early. No compensation was provided for participation in this study. They were informed that their decision to participate or not participate would in no way affect their class standing or final grade. Students were informed that their results would be reported in aggregate form so that individual results could not be tied back to any single participant, and that their participation would in no way affect their standing in naval aviation training or on their naval careers. The survey was available via pen and paper or by electronic web enabled device. The students were permitted to choose which version to use. Both versions of the survey were identical in all ways including programmed skipping of questions based on prior responses.

All 302 students recruited agreed to participate in the survey. This represented a response rate of 100%. All sampled personnel were college graduates and in good health and fitness.

Among those who completed the survey, 79% ($n = 239$) reported consuming energy drinks within the last year; therefore, this study focused on this sub-population of energy drink consumers. To assist participants in properly identifying energy drinks, this study utilized similar strategies used in prior energy drink studies (Woolsey et al., 2014b; Woolsey et al., 2015). The instrument identified examples of popular energy drinks and included pictures, serving sizes, and commonly sold product quantities. Age of first use was determined by asking the question "How old were you when you first started consuming energy drinks?"

In order to determine if the age of first use affected consumption patterns, the participants self-reported their age of first energy drink use, as well as items to determine frequency and quantities consumed. To measure how many energy drinks students consumed, ranged response scales were used. Because energy drinks are sold in varying sizes, content is unregulated by the U.S. Food and Drug Administration, and research has indicated the potential for mislabeling of ingredient