The multiplicative effect of combining alcohol with energy drinks on adolescent gambling

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HIGHLIGHTS

- There is a growing concern about the use of alcohol mixed with energy drinks (AmED).
- This study examined the association between at-risk/problem gambling and AmED in youth.
- The study comprised a large sample representative of the Italian high school population.
- AmED might pose significantly greater risk to experience gambling-related harms.

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ABSTRACT

Purpose: There has been increased concern about the negative effects of adolescents consuming a combination of alcohol mixed with energy drinks (AmED). To date, few studies have focused on AmED use and gambling. The present study analyzed the multiplicative effect of AmED consumption, compared to alcohol alone, on the likelihood of at-risk or problem gambling during adolescence.

Methods: Data from the ESPAD® Italia 2015 study, a cross-sectional survey conducted in a nationally representative sample of students (ages 15 to 19 years) were used to examine the association between self-reported AmED use (≥ 6 times, ≥ 10 times, and ≥ 20 times during the last month) and self-reported gambling severity. Multivariate models were used to calculate adjusted prevalence ratios to evaluate the association between alcohol use, AmED use, and gambling among a representative sample of adolescents who reported gambling in the last year and completed a gambling severity scale (n = 4495).

Results: Among the 19% students classed as at-risk and problem gamblers, 43.9% were classed as AmED consumers, while 23.6% were classed as alcohol consumers (i.e. did not mix alcohol with energy drinks). In multivariate analyses that controlled for covariates, AmED consumers were three times more likely to be at-risk and problem gamblers (OR = 3.05) compared to non-consuming adolescents, while the effect became less pronounced with considering those who consumed alcohol without the addition of energy drinks (OR = 1.37).

Conclusions: The present study clearly established that consuming AmED might pose a significantly greater risk of experiencing gambling-related problems among adolescents.

1. Introduction

Over the last decade, a large number of products containing high levels of caffeine have emerged and have been disproportionally targeted toward adolescents and young adults. This has led to increased concern by pediatricians toward their potentially serious adverse effects on children and adolescents (Seifert, Schaechter, Hershon, & Lipsultz, 2011). Moreover, the sales of energy drinks grew 60% between 2008 and 2013 and have coincided with increased reports of emergency department visits because of its consumption combined with that of alcohol (Bonar et al., 2015). For these reasons, there is a growing interest and concern about the use of alcohol mixed with energy drinks...
(AmED) especially among youth. Because of this, the US Food and Drug Administration (FDA) banned the sale of energy drinks premixed with alcohol in 2010 (FDA, 2010). However, individuals (and particularly adolescents) continue to mix energy drinks with alcohol. For instance, studies have shown that 23% to 47% of adolescents and young adult alcohol users consume alcohol-mixed energy drinks (Peacock, Pennay, Droste, Bruno, & Lubman, 2014).

Examining this phenomenon, a review of the negative effect of AmED found that consuming alcohol mixed with energy drinks was more dangerous than consuming alcohol alone because of the stimulant effects of caffeine contained in energy drinks (Striley & Khan, 2014). This stimulant effect might be perceived as offsetting the depressant effects of alcohol, resulting in adolescents feeling less intoxicated than they actually are, and described as “wide awake drunkenness” (Arria & O’Brien, 2011). AmED-induced underestimation of intoxication has been found to be associated with various risky behaviors (such as alcohol and drug use, smoking, sexual risk-taking, and violence) among adolescents and young adults (Miller, 2008; Scalese et al., 2017).

However, AmED may also be associated with problem gambling. In the last decade, problem gambling among adolescents has emerged as an increasing social and public health issue (Molinaro et al., 2014). For instance in Italy, results from the European-School-Survey-Project-on-Alcohol-and-Other-Drugs (ESPAD *Italia) showed that during 2014, 39.3% of high school students gambled at least once in the past 12 months (boys = 48.8%; girls = 29.7%) and 11.1% and 7.6% of these were classified as at-risk and problem gamblers respectively (DAP, 2016).

Problem gambling has been shown to have multiple-related risk factors similar to those of other addictive behaviors (Leeman & Potenza, 2012). Given the similarity in the risk factors between gambling and alcohol and drug use and misuse, it is possible that the use of AmED is positively associated with gambling problems. According to Pennay et al. (2015), the association between AmED use and problem gambling intuitively makes sense considering that caffeine in energy drinks might result in higher impulsivity before or during gambling session or also be used to prolong wakefulness and attention while gambling. Additionally, studies conducted in animals have suggested increased impulsive decision-making following acute caffeine administration (Diller, Saunders, & Anderson, 2008; Flora & Dietze, 1993). From this perspective, AmED may affect at-risk and problem gambling (ARPG).

Gamblers have a high tolerance toward risk (Brevers, Bechara, Clereremans, & Noël, 2013), and pathological gambling has been associated with alterations of dopaminergic regions linked to reward, risk, and motivation (Potenza, 2014). Furthermore, both alcohol and caffeine increase dopamine through the body’s reward pathways via dopamine and adenosine receptors in the nucleus accumbens (NA) and the dorsal striatum (DS) (Fuxe, Ferré, Genedani, Franco, & Agnati, 2007). The DS is involved in response control, decision-making, and habitual action whereas the NA is involved in learning and behaviors that are reward-associated, particularly drug abuse (Fuxe et al., 2007). Decreased striatal activation during reward processing has been found in gambling disorder, binge-eating, and alcohol dependence (Potenza, 2014). Repeated consumption of caffeine-mixed alcohol causes stronger activation of the dopaminergic reward pathway than caffeine or alcohol alone (Robins, Lu, & van Rijn, 2016). Furthermore, previous studies examining neurobiological correlates of problem gambling have identified abnormalities in brain dopamine systems that are crucial for reward sensitivity (Wardell, Quilty, Hendershot, & Bagby, 2015). Therefore, we hypothesized that this combined consumption could be connected to the propensity for ARPG. Thus, repeated co-consumption of energy drinks and alcohol may increase the probability of ARPG.

To date, few studies have focused on AmED use and gambling. More specifically, to the best of our knowledge only two studies have examined the association between AmED use and gambling, and both of these were among the adult population. In the first study, Pennay et al. (2015) found that odds of being an alcohol and energy drink (AED) consumer increased as a function of reporting moderate risk/problem gambling. The second study involved a community sample and reported that matched-frequency participants (AmED and alcohol use) reported significantly lower odds of spending more money than planned and gambling (Peacock et al., 2015). Based on the findings of these two studies, it appears that the relationship between AmED and gambling is inconsistent. The inconsistency might be due to methodological flaws and relevant differences in the population studied. For example, Pennay et al. (2015) used a measure of gambling severity (Problem Gambling Severity Index- Ferris & Wynne, 2001), while Peacock et al. (2015) considered measures for financial outcomes during AmED sessions (i.e., ‘spent more money than planned’ and ‘gambled’). In addition, one study described patterns of AmED use in a representative sample of the Australian population (Pennay et al., 2015), while the second used a convenience sample comprising a within-participant matched-frequency sample (i.e., participants who reported the same frequency of alcohol and AmED use). By using a large-scale nationally representative sample of Italian youth, the principal aim of the present study was to clarify the association between AmED use and adolescent ARPG. According to previous studies suggesting that there is a synergistic effect between stimulant use and alcohol use in combination (Arria & O’Brien, 2011), it was hypothesized there would be a multiplicative effect of AmED consumption, compared to alcohol alone, among at-risk and problem gambling adolescents.

2. Methods

2.1. Study population

The present study used the data from ESPAD*Italia 2015, a national school-survey conducted annually to monitor risk-behaviors among Italy's high school students, and is included in the largest cross-national research project ESPAD (European School Survey Project on Alcohol and Other Drugs). The survey is included in the Scholastic Plan for Education (Decree of the President of the Italian Republic n.275/1999, Art. 8), edited and approved by Collegial Bodies, including teachers, parents, and students (Legislative Decree n.297/1994). Multistage stratified sampling was used as the sampling procedure. First, the provinces were stratified by geographical area (North, Central, South, and Islands) and by population density. Second, the schools were stratified by type of school and by geographical location (urban and rural). Finally, a number of schools were extracted from each stratum and within each school one or more sections were chosen, in which the questionnaire was administered from the first to the fifth class. Parental permission for their children to participate was obtained prior to survey administration. Students were informed that participation was anonymous and voluntary. The response rate of participating schools was 87.7%. Self-administered questionnaires were completed by a representative sample of high school students, aged 15–19 years, in school classrooms (n = 13,725). To study the variables associated with different types of gamblers (e.g., “non-problem” gamblers, “at-risk” gamblers, “problem” gamblers), a subsample of 4495 Italian high school students who reported gambling in the last year and completed the South Oaks Gambling Screen-Revised for Adolescents (SOGS-RA) (Winters, Stinchfield, & Fulkerson, 1993) was extracted from the dataset for further analysis (see Table 1 for the sample characteristics). Gambling was more prevalent among males and the sample comprised 62.5% male adolescents aged between 15 and 19 years.

3. Measures

3.1. Dependent variable

Gambling severity was assessed using the SOGS-RA (Colasante et al., 2014; Winters et al., 1993), comprising 12 dichotomous items (no = 0; yes = 1) assessing gambling behavior and gambling-related problems.
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