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Research report

Self-reported physiological and psychological side-effects of an acute alcohol and energy drink dose ☆

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ABSTRACT

Objective: There have been repeated calls from health professionals and policy-makers to clarify the side-effects of the increasingly popular consumption trend of alcohol mixed with energy drinks (AmED). There is a dearth of research assessing the differential effects of AmED relative to alcohol by comparing self-reported psychological and physiological outcomes whilst under the influence of these substances. The aim of the present study was to examine the acute effects of a moderate alcohol and energy drink (ED) dose on self-reported psychological and physiological outcomes. *Method:* Using a single-blind, placebo-controlled, crossover design, 28 adults completed four sessions where they were administered: (i) 0.50 g/kg alcohol, (ii) 3.57 mL/kg ED, (iii) AmED, and (iv) placebo. Participants independently completed the Profile of Mood States and a Somatic Symptom Scale at baseline and at 30 and 125 min after beverage administration. *Results:* Breath alcohol concentration peaked at .068% and .067% in the alcohol and AmED conditions, respectively. There were no interactive alcohol and ED effects on self-reported psychological outcomes. Treatment effects for physiological outcomes generally only related to alcohol or ED administration, with the exception of a moderate magnitude decrease in heart palpitation ratings following alcohol relative to AmED. Decreased muscular tension ratings were evident when the two constituents were consumed separately relative to placebo. *Conclusions:* The results provide evidence of few subjective changes in physiological and psychological state after consuming AmED relative to alcohol. The majority of treatment-based changes arose from the independent effects of alcohol or ED, rather than being modified by their interaction. However, research extending into higher dosage domains is required to increase outcome generalisability for consumers in the night-time economy.

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Introduction

Consumption of alcohol mixed with energy drinks (AmED) is an increasingly popular trend amongst adolescents and young adults, with prevalence estimates of recent AmED use among college student convenience samples ranging between 23% and 48% (Brache & Stockwell, 2011; Oteri, Salvo, Caputi, & Calapai, 2007). Recent publications outlining increases in energy drink (ED)-related emergency department visits (Substance Abuse, 2011) and poison information centre calls (Gunja & Brown, 2012) have heightened concerns regarding the health effects of EDs and AmED. Several national bodies have released public statements highlighting the potential additional health harms of AmED consumption (Australian Medical Association, January, 2013; United States Food and Drug Administration, November, 2010). However, there is a dearth of research directly comparing the pharmacological effects of AmED versus alcohol on perceived physiological and psychological outcomes. Only one recent community survey by Peacock, Bruno, and Martin (2012) has directly compared the subjective side-effects of AmED and alcohol consumption to date. This comparison revealed that AmED consumers self-reported significantly greater odds of experiencing subjective physiological and psychological side-effects related to over-stimulation (i.e., heart palpitations, sleeping difficulties, agitation, tremors, increased speech speed, jolt and crash episodes, irritability and tension), and lower odds of side-effects related to sedation (i.e., nausea, slurred speech, and walking and vision difficulties) when ingesting alcohol with ED relative to without ED (Peacock et al., 2012). However, recall bias may have been an issue, as reporting required retrospective recall of side-effects in the preceding six months.

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Assessment of acute subjective side-effects in a controlled environment rules out such biases. However, the few experimental studies conducted to date have generally focused on overall stimulation and sedation ratings (Marczinski, Fillmore, Bardgett, & Howard, 2011; Marczinski, Fillmore, Henges, Ramsey, & Young, 2012, 2013; Peacock, Bruno, Martin, & Carr, 2013). Only Alford, Hamilton-Morris, and Verster (2012) have assessed a range of psychological outcomes, generally finding no significant change in ratings after ingestion of alcohol (0.046% and 0.087% BrAC) alone and in combination with ED. However, the researchers acknowledge that the between-subjects design and small sample size may have contributed to the absence of statistically significant findings. Ferreira, de Mello, Pompeia, and de Souza-Formigoni (2006) have directly assessed subjective physiological outcomes, demonstrating lower ratings of dry mouth and alterations of motor coordination 120 min following co-ingestion of 0.65 g/kg and 1.0 g/kg alcohol with 3.57 mL/kg ED relative to these doses without ED. In contrast with AmED consumers' retrospective self-report of AmED experiences (Peacock et al., 2012), indices of over-stimulation (e.g., tremor, tachycardia) did not differ between AmED and alcohol conditions.

The dearth of research assessing subjective acute physiological and psychological outcomes of alcohol and ED consumption limits the available evidence for an informed response to the international rise in AmED use and associated harms. Following from repeated calls from researchers and health professionals, the present study was undertaken to determine the effects of a moderate alcohol and low ED dose on subjective physiological and psychological outcomes, specifically the Profile of Mood States (McNair, Lorr, & Droppleman, 1979) and a Somatic Symptom Scale derived from Ferreira et al. (2006).

Method

Participants

Twenty-eight adults (14 males; $M = 19.5$, $SD = 1.8$, range 18–25 years) participated in a single-blind, placebo-controlled, crossover study. The sample consisted of regular caffeine (5–28 caffeinated products in the preceding week), alcohol (minimum of two standard drinks in the preceding fortnight), and ED (minimum of one standard 250 mL ED in the preceding month; maximum consumption of one standard 250 mL ED per day in the preceding month) consumers who self-reported no: (i) significant physical or psychiatric history, (ii) current pregnancy or lactation and (iii) regular current tobacco, medication, or illicit drug use. Volunteers who scored 16 or higher on the Alcohol Use Disorders Identification Test (AUDIT; Babor, Higgins-Biddle, Saunders, & Monteiro, 2001) were excluded. The study protocol was approved by the Human Research Ethics Committee Tasmania Network and volunteers provided informed consent. Participants were informed they may receive alcohol (maximum of six standard alcoholic drinks) and ED (maximum of three standard 250 mL EDs). Recruitment occurred via public advertisements at the University of Tasmania. Participants were reimbursed 120 AUD.

Measures

The Profile of Mood States (POMS; McNair et al., 1979) was used to assess perceived current psychological state. Participants rated how accurately 65 adjectives described their current mood on a 5-point Likert scale ranging from 0 'not at all' to 4 'extremely'. Total Mood Disturbance and Tension–Anxiety, Depression–Dejection, Confusion–Bewilderment, Anger–Hostility, Fatigue–Inertia, and Vigour–Activity subscale scores were calculated, with higher scores indicating greater perceived disturbance.

A Somatic Symptom Scale (SSS), consisting of 20 100-mm visual analogue scales (0 mm anchor designated 'not at all', 100 mm anchor designated 'extremely'), was used to assess current perceived physiological state (e.g., 'headache', 'dizziness'); items were derived from previous AmED research by Ferreira et al. (2006). Item scores ranged from 0 to 100, with higher scores indicating greater intensity of the physiological outcome.

A Beverage Rating Scale (BRS; Fillmore & Vogel-Sprott, 2000) was used to assess perceived alcohol and ED intake and confirm successful placebo manipulation. Participants reported the perceived number of alcoholic drinks (each drink 4.8% alcohol/volume or 1.4 standard drinks; range 0–10 drinks increasing in 0.5 increments) and standard 250 mL EDs (range 0–3 increasing in 0.5 increments) administered.

Treatment conditions

Participants were randomly assigned a counterbalanced treatment order: (i) 0.50 g/kg vodka (37.5% alcohol/volume Smirnoff Red Label®), (ii) 3.57 ml/kg Red Bull® ED (Red Bull GmbH), (iii) AmED, and (iv) placebo. The alcohol dose (decreased to 85% for females) was chosen to yield a peak BrAC of 0.05%, the Australian legal limit for driving, while the ED dose was equivalent to one 250 mL ED per 70 kg person, reflecting the dosing protocol adopted by Ferreira et al. (2006). The specific beverages (vodka and Red Bull®) were chosen based on endorsement in a recent Australian survey study as the most popular AmED mixers (Peacock et al., 2012). The placebo alcohol dose was achieved by floating 5 ml vodka on each beverage portion, with a light alcohol mist sprayed on the inner container (Marczinski & Fillmore, 2006). The placebo ED dose was 3.57 mL/kg Red Bull® minus caffeine, taurine, glucuronolactone, inositol, and B vitamin complex content; sugar content was identical for active and placebo beverages (27 g/250 mL). Data collectors, participants, and data analysts were blind to ED administration; only participants and data analysts were blind to alcohol administration.

Procedure

Participants attended a 90-min familiarisation session where they completed screening measures, were weighed for substance administration purposes, and familiarised with the experimental procedure. Participants then attended four 180-min experimental sessions conducted between 0930 and 1900 and separated by a minimum of two and maximum of 10 days. Participants were required to fast for four hours (excluding consumption of a standard breakfast bar 90 min prior to session commencement) and abstain from caffeine for eight hours, from alcohol and prescription medication for 24 h prior to each session, and from illicit drugs for the duration of participation. Following completion of baseline POMS and SSS measures, participants were administered the beverage in two portions served in opaque lidded cups, consuming each portion within a 5-min period. Post-drink administration of the POMS and SSS occurred 30 min and 125 min after initiation of beverage consumption, with the BRS administered at the later time point. BrAC was also tested at these points using an Alcolizer HH-2 unit. All self-report data were collected via computerised survey software to minimise experimenter bias. It should be noted that participants completed several cognitive tasks, and electroencephalographic data were collected, in the interval between the post-drink assessments (partial results detailed in Peacock et al., 2013). At the conclusion of the session, participants received a detoxification meal and remained at leisure in the laboratory until recording two BrAC measurements of .030% or less over 15 min.

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