JOURNAL OF CAFFEINE RESEARCH
Volume 2, Number 2, 2012

DOI: 10.1089/caf.2012.0015

Alcohol Mixed with Energy Drink Use and Sexual Risk-Taking: Casual, Intoxicated, and Unprotected Sex

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Objective: This study examined the confluence of several behaviors common to U.S. young adults: caffeinated energy drink use, alcohol use, and sexual risk-taking. The author examined relationships between the use of energy drinks mixed with alcohol (AmEDs) and three sexual risk behaviors: casual sex (i.e., intercourse with a nonexclusive and/or nonromantic partner), intoxicated sex (i.e., intercourse while under the influence of alcohol and/or illicit drugs), and unprotected sex (i.e., intercourse without use of a condom).
Method: Logistic regression analyses were employed to analyze data from a cross-sectional survey of 648 sexually active undergraduate students at a large public university.
Results: After controlling for risk-taking norms and frequency of noncaffeinated alcohol use, AmED use was associated with elevated odds of casual sex and intoxicated sex but not unprotected sex.
Conclusions: Although further studies are needed to test for event-level relationships, AmED use should be considered a possible risk factor for potentially health-compromising sexual behaviors.

Introduction

Potential consequences of risky sexual behavior in U.S. young adults are well-documented. Young people aged 15–24 account for nearly half of new cases of sexually transmitted infections (STIs), including a growing proportion of new HIV diagnoses.[1,2] Unprotected sex with a casual partner whose sexual history is unknown dramatically increases the odds of exposure to STIs.[3] Sexual risk-taking may also result in unwanted pregnancy,[4] stigmatization,[5] depression,[6] and/or sexual coercion.[7] Though either gender may experience adverse outcomes, most if not all of these consequences fall disproportionately on women.[5,8]

Nevertheless, sexual risk-taking is a longstanding feature of the social landscape of U.S. young adults. Increasingly common is the practice of hooking up, or engaging in a relatively casual sexual encounter for which scripted expectations for further obligations, commitment, or intimacy are minimal, if not absent altogether.[9] In one recent study, 78% of undergraduates reported hooking up at least once in the past year, with more than one-third reporting penetrative intercourse in these encounters.[10] Casual hookups are also commonly facilitated by inhibition-loosening levels of intoxication.[3,11] Drinking increases the likelihood of indiscriminate sexual activity, including sex with a casual, unplanned, and/or high-risk partner.[12–16] Although the relationship between drinking and condom use is complex,[12,17,18] alcohol use may in some instances reduce the odds of using barrier protection against pregnancy or STIs.[19] In 2011, fewer than two-thirds of sexually active college students reported condom use during their most recent intercourse, and one in six alcohol-using students reported having had unprotected sex as a consequence of his or her drinking in the past 12 months.[4]

Over the past decade, caffeinated energy drinks mixed with alcohol (AmEDs) have become an increasingly common feature of the young adult recreational landscape, with about one in four college students reporting past-month use.[20–22] A growing body of research has found AmED use to be associated with significantly more risky behavioral outcomes than noncaffeinated alcohol use alone. O'Brien *et al*.[23] found that college student AmED users reported more drinks per typical occasion, twice as much drunkenness and binge drinking, and more alcohol-related unwanted outcomes than those who drank alcohol alone; they were more likely to take advantage of someone or be taken advantage of sexually, ride with a drunk driver, be hurt or injured, require medical treatment, and (for moderate drinkers) drive while intoxicated. These findings were largely replicated by Brache and Stockwell[20] in a Web survey of Canadian students, for whom frequent AmED use was associated with more frequent drinking and with higher odds of heavy episodic drinking, drinking and driving, or being hurt or injured. In an event-level field study of bar patrons in a college bar district, Thombs *et al*.[24] found that young adults who had been drinking AmEDs were three times as likely to leave the bar highly intoxicated, and four times as likely to intend to drive that

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way, compared with those using noncaffeinated alcohol alone. Several other studies using Italian or Canadian college samples[25–27] have also found that AmED users were significantly more likely than non-AmED alcohol users to engage in heavy drinking and/or heavy episodic drinking.

Preliminary research suggests possible relationships between AmED use and the likelihood of sexual risk-related outcomes (e.g., elevated rates of sexual victimization)[23] or risk-tolerant attitudes (e.g., stronger endorsement of sexually aggressive or promiscuous norms).[22] Frequent AmED use has been associated with sensation-seeking[28–30] and a propensity for risk-taking in general,[22] and both may contribute to sexual risk-taking. However, there are several reasons to suspect that AmED use provides a stronger catalyst for unintended or escalated sexual risk than alcohol use alone, even after accounting for personality or other selection effects.

First, some researchers have suggested that AmED users may be especially prone to underestimate their own level of alcohol-related impairment. Pharmacologically, caffeine enhances perceived stimulation and reduces the lethargy often associated with drunkenness,[31] allowing the user to remain wakeful and alert through a longer, heavier drinking episode. Its coadministration with alcohol also diminishes subjective intoxication[32,33] and distorts estimates of alcohol intake.[34] These effects reinforce the common misconception that caffeine antagonizes alcohol, most widely expressed via the widespread and longstanding belief in coffee as a "sober up quick" folk remedy.[35] Further, AmEDs have stronger priming effects than alcohol alone, reinforcing the desire to drink more heavily.[34] These combined factors may help to explain why AmED use is associated with increased volume of alcohol intake[26] and intoxication[36] during drinking sessions.

Second, AmED use may undermine the user's strategic defenses against adverse drinking outcomes, including unintended sexual risk-taking. Placebo studies have shown that people who believe themselves to be intoxicated often attempt to compensate by increasing their conscious vigilance against undesired outcomes.[37,38] For example, drinkers who are led to expect significant alcohol-related impairment employ adaptive responses that improve psychomotor performance[39] and, to a lesser extent, inhibitory control.[40] AmED drinkers who underestimate their own intoxication may be less likely to engage these defenses, even though caffeine leaves alcohol-based impairments in psychomotor and cognitive performance more or less intact.[32,37,41,42] Mixing caffeine and alcohol has in fact been demonstrated to result in reduced compensation for deficits in psychomotor performance in the laboratory[43] and in field studies of intentions to drive drunk.[24]

Whereas the subjective perception of relative sobriety undermines in-the-moment compensatory vigilance, the erroneous expectation that caffeine will antagonize alcohol may also undermine consciously planned, prospective strategies to minimize risk. Many drinkers routinely use protective strategies to limit alcohol consumption (e.g., spacing drinks and avoiding drinking games)[44,45] or to ameliorate the consequences, sexual or otherwise, of impaired decision-making (e.g., carrying a "just in case" condom when partying, or employing a "friends don't let friends hook up drunk" buddy monitoring system).[46,47] AmED users may perceive less need to use such protective strategies, since they anticipate that the caffeine they consume will to some degree counteract the effects of the accompanying alcohol.

A further goal of this analysis was to determine whether level of partner intimacy at most recent intercourse moderated the global effect of AmED use on the odds of unprotected sex. Previous studies have further found that the dynamic between alcohol use and protective sexual behavior, particularly condom use, is complex.[12] Experimental studies clearly demonstrate that blood alcohol content is related to intentions to engage in unsafe sex (i.e., sexual intercourse without a condom).[48] Alcohol myopia theory also posits that intoxication tends to increase the likelihood of reckless in-the-moment sexual decision-making,[49,50] particularly for women.[51] However, the relationship is complicated by the fact that condom use is generally less consistent with a known than a casual partner. In two event-level studies of college student drinking, partner type, and sexual behavior, alcohol use was more closely associated with an increased risk for unprotected sex with a casual partner than with a steady partner.[52,53] In contrast, a third event-level study found—for women only—a greater alcohol-related risk of unprotected sex with steady but not casual partners.[54] Thus, the impact of intoxication on condom use is conditioned by both gender and level of partner intimacy (i.e., casual vs. steady partner).

There is reason to suspect that associations between AmED use and risky sex may be stronger for women than for men. Social risk-taking is conditioned by a lingering double standard whereby casual sex is still more stigmatized for women.[5,8] Increasingly self-conscious discourse about this double standard in the era of postfeminism has led to a greater awareness of the parallels between female and male promiscuity, and to greater sexual freedom for women so long as it occurs within the context of a steady relationship. Still, terms like "slut" or "whore" when applied to a male "player" often seem whimsical or playful. In contrast, the same terms applied to a sexually active woman tend to be stinging at best and lethal to the reputation at worst. Given this context, compensatory vigilance plays a larger role in women's sexual decision-making than it does for their male peers.[46,52] To the extent that AmED use undermines women's perceived need for such protective behavioral strategies, its global association with risky sex should thus be stronger for women than for men.

Hypotheses: The present analysis tested the main hypothesis that AmED use was associated with elevated odds of sexual risk-taking (i.e., casual, intoxicated, and/or unprotected sex). Additional hypotheses were tested regarding the moderating effects of gender and level of partner intimacy. To rule out the most likely third-variable explanations for links between AmED use and sexual risk-taking, the analyses also accounted for several potential confounders, including age, socioeconomic status, propensity for risk, and frequency of noncaffeinated alcohol use.

Methods

Participants and procedures

The study included 648 participants (47.5% women) enrolled in introductory-level courses at the University at Buffalo, a large public university in the northeastern United States. Participants ranged in age from 18 to 40 years ($M = 20.14$) but were mostly clustered at the lower end of the age spectrum; 66.5% were younger than 21, the legal

drinking age. Participants who reported they had never been sexually active (i.e., never had vaginal, anal, or oral sex with a partner) were excluded from the present analyses. The study was approved by the university's Social and Behavioral Sciences Institutional Review Board for the protection of human subjects.

In-class recruitment announcements for the study were made to students in seven large introductory-level sociology, economics, or communication courses, followed up with an e-mail recruiting invitation or posting to a restricted course Web site that included a 45-minute anonymous questionnaire as an attachment. Participants printed out and returned their completed questionnaires in person to a specified drop location, where they received $10.00 compensation for their time and effort; participation also counted for research credit toward fulfillment of a course requirement in some courses. Signed documentation of informed consent was obtained from all participants. Although cross-enrollment in some courses prevented an exact count of students who received an invitation to participate, the estimated response rate was 52%.

Measures

Three forms of risky sex were assessed. Casual sex was a dichotomous item coded affirmatively (0 = no, 1 = yes) for participants who agreed with one or more of the following characterizations of their most recent sexual intercourse: no exclusive relationship with partner, not in love with partner, and/or did not know partner well (Cronbach's alpha = 0.73). Intoxicated sex was coded affirmatively (0 = no, 1 = yes) if the respondent reported being "drunk or high" during most recent sexual intercourse. Unprotected sex was coded affirmatively (0 = no, 1 = yes) if the respondent reported not using a condom during most recent intercourse. Thirty-one students who responded "not applicable" to the question on condom use (i.e., both partners were women) were omitted from that analysis only.

Participants reported how often in the past 30 days they had consumed at least one AmED, defined as "a drink that mixed alcohol with Red Bull or a similar energy drink." The seven-point response range included 0 days (coded as 0.0), 1–2 days (recoded to categorical midpoint as 1.5), 3–5 days (4.0), 6–9 days (7.5), 10–19 days (14.5), 20–29 days (24.5), and all 30 days (30.0). The frequency of AmED use was not normally distributed, with most cases at or near zero; the variable was therefore recoded dichotomously as any past-month AmED use (0 = no, 1 = yes).

To rule out the most likely third-variable confounder links between AmED use and sexual risk-taking, the analysis also accounted for heavy episodic ("binge") drinking as well as a normative propensity for risk-taking. Using the response rate indicated previously, participants reported on how many of the past 30 days they had engaged in heavy episodic drinking (defined as five or more drinks for men and four or more drinks for women).[55] To assess propensity for risk-taking, students completed the 10-item risk-taking subscale of Mahalik's Conformity to Masculine Norms Inventory (CMNI).[56] This subscale (Cronbach's alpha = 0.84) included items such as "I enjoy taking risks" and "I prefer to be safe and careful (reversed)," and has been validated for assessment of risk-taking norms in women as well as men.[57] The analyses also included three additional sociodemographic controls: gender, age, and parental educational attainment (as a proxy for socioeconomic status). To assess parental education, students identified the highest level of schooling attained by either parent: did not finish high school (=10), high school degree or general equivalency degree (=12), some college or technical certification (=14), bachelor's degree (=16), or postgraduate/professional degree, for example, M.A., M.B.A., Ph.D., or M.D. (=18).

Results

Characteristics of the sample

Nearly one in three (29.3%) sexually active students reported AmED use during the month prior to the survey (see Table 1). Heavy episodic drinking was considerably more common, with 69.6% reporting any episodes and 51.2% reporting three or more episodes in the past month. At their most recent sexual encounter, 45.1% reported having a casual partner, 24.8% reported being intoxicated, and 43.6% reported that they did not use a condom. These three sexual risk indicators were significantly associated, with Pearson

Table 1. Descriptive Characteristics (Means and Standard Deviations) for Whole Sample and by Gender[a]

	All n = *648*	*Women* n = *308*	*Men* n = *340*
% Women	47.5	—	—
Age (18–40 years)	20.14	20.02	20.25
Parental education (mean)	15.40	15.34	15.45
Risk-taking norms (1 = low; 4 = high)	2.49	2.34	2.63***
Days of heavy episodic drinking, past month	4.93	3.45	6.27***
% Used AmEDs, past month	29.3	25.3	32.9*
% Casual partner at most recent sexual intercourse	45.1	34.1	55.0***
% Intoxicated at most recent sexual intercourse	24.8	15.9	32.9***
% No condom at most recent sexual intercourse[b]	43.6	52.5	35.5***

[a]Pearson chi-squares were used to test for significant differences in dichotomous (%) variables: gender, past-month AmED use, and risk characteristics of most recent sexual intercourse. One-way ANOVA F-tests were used to test for significant differences in continuous (mean) variables: age, parental education, risk-taking norms, and past-month heavy episodic drinking.

[b]Thirty-one students responded to the question about condom use with "not applicable" and were therefore excluded from descriptive and multivariate analyses of unprotected sex.

*$p < 0.05$; **$p < 0.01$; ***$p < 0.001$.

ANOVA, analysis of variance; AmEDs, energy drinks mixed with alcohol.

Table 2. Percentage and Mean Comparisons[a] of Sample Characteristics, by Sexual Risk-Taking at Most Recent Intercourse

	Casual sex		*Intoxicated sex*		*Unprotected sex*[b]		*All three risks*	
	No (n = 356)	*Yes (n = 292)*	*No (n = 487)*	*Yes (n = 161)*	*No (n = 349)*	*Yes (n = 270)*	*No (n = 607)*	*Yes (n = 41)*
% Women	57.0	36.0***	53.2	30.4***	40.1	57.4***	48.4	34.1
Age	20.21	20.06	20.18	20.01	19.91	20.46**	20.13	20.37
Parental education	15.29	15.53	15.25	15.84**	15.38	15.45	15.37	15.79
Risk-taking norms	2.38	2.63***	2.43	2.67***	2.48	2.51	2.48	2.72***
Days of heavy episodic drinking	3.94	6.14***	3.74	8.53***	5.33	4.65	4.72	8.09**
% Used AmEDs	21.9	38.4***	21.1	54.0***	29.5	29.6	27.8	51.2**

[a]Pearson chi-squares were used to test for significant differences in dichotomous (%) variables: gender and past-month AmED use. One-way ANOVA F-tests were used to test for significant differences in continuous (mean) variables: age, parental education, risk-taking norms, and past-month heavy episodic drinking.

[b]Thirty-one students responded to the question about condom use with "not applicable" and were therefore excluded from descriptive and multivariate analyses of unprotected sex.

*$p < 0.05$; **$p < 0.01$; ***$p < 0.001$.

product-moment correlations of 0.40 for casual/drunk sex ($p < 0.001$), −0.18 for casual/unprotected sex ($p < 0.001$), and −0.08 for drunk/unprotected sex ($p < 0.05$).

While women and men did not differ significantly on demographic characteristics, such as age or parental educational attainment, there were clear gender disparities with respect to risk-taking norms, drinking, and sexual behavior. Women scored significantly lower on the CMNI Risk–taking scale (2.34 vs. 2.63, $p < 0.001$), engaged in heavy episodic drinking less frequently (3.45 days vs. 6.27 days, $p < 0.001$), and reported lower rates of AmED use (25.3% vs. 32.9%, $p < 0.05$) than their male counterparts. Women were also less likely than men to report having a casual partner (34.1% vs. 55.0%, $p < 0.001$) or being intoxicated (15.9% vs. 32.9%, $p < 0.001$) at last sexual intercourse, but were more likely to report unprotected sex (52.5% vs. 35.5%, $p < 0.001$).

Unadjusted comparisons of sexual risk-takers and nonrisk-takers at most recent intercourse (Table 2) show different patterns for indiscriminate sexual activity (i.e., sex with a casual partner and/or sex while intoxicated) versus failure to use protective measures (i.e., no condom). Both casual sex and intoxicated sex were significantly associated with higher CMNI scores and more frequent alcohol use. AmED use was significantly more common among those having casual sex (38.4% vs. 21.9%, $p < 0.001$) or intoxicated sex (54.0% vs. 21.1%, $p < 0.001$), compared with those who did not report these risks. In contrast, only demographic characteristics (i.e., gender and age) predicted nonuse of a condom. Participants who reported the highest level of risk, that is, unprotected sex with a casual partner while intoxicated, were nearly twice as likely as lower-risk participants to have used AmEDs in the past month (51.2% vs. 27.8%, $p < 0.01$).

Multivariate analyses

Table 3 shows relationships between AmED use and high-risk behaviors during most recent sexual intercourse, with Model 1 equations including main effects only and Model 2

Table 3. Predicting Risky Sex (Casual, Intoxicated, and Unprotected Sexual Intercourse): Main Effects and Gender Interactions

	Casual sex[a]		*Intoxicated sex*[a]		*Unprotected sex*[a]	
	OR	*95% CI*	*OR*	*95% CI*	*OR*	*95% CI*
Model 1: Main effects only						
Women	0.58**	0.41–0.83	0.57*	0.37–0.88	2.21***	1.54–3.18
Age	0.97	0.89–1.05	0.96	0.86–1.07	1.17**	1.07–1.29
Parental education	1.01	0.94–1.09	1.10	1.00–1.20	1.03	0.96–1.11
Days of heavy episodic drinking	1.02	0.99–1.05	1.07***	1.04–1.11	0.99	0.96–1.02
Risk-taking norms	2.90***	1.88–4.48	1.92**	1.17–3.14	2.04**	1.33–3.11
AmED use	1.74**	1.18–2.56	2.84***	1.87–4.33	1.25	0.84–1.85
Casual partner					0.45***	0.31–0.64
Hosmer & Lemeshow x^2	7.90		13.91		5.26	
Model 2: Main and interaction effects						
Women × AmED use	0.89	0.43–1.84	0.96	0.42–2.21	0.70	0.33–1.49
Casual partner × AmED use					0.94	0.44–1.99
Hosmer & Lemeshow x^2	11.93		13.90		4.63	

[a]ORs and 95% CIs are derived from hierarchical logistic regression analyses. Model 2 includes all main effects from Model 1. Hosmer & Lemeshow x^2 was nonsignificant for all equations.

*$p < 0.05$; **$p < 0.01$; ***$p < 0.00$.

CI, confidence interval; OR, odds ratio.

equations adding product terms to test for moderation by gender and (for unprotected sex only) level of partner intimacy. After controlling for gender, age, parental education, frequency of heavy episodic drinking, and endorsement of risk-taking norms, AmED use was associated with higher odds of self-reported casual sex (odds ratio [OR] = 1.74, confidence interval [CI]: 1.18–2.56, $p < 0.01$) and intoxicated sex (OR = 2.84, CI: 1.87–4.33, $p < 0.001$). Risk-taking norms were also associated with elevated odds of all three sexual risk-taking indicators. Having a casual partner was negatively associated with unprotected sex (OR = 0.45, CI: 0.31–0.64, $p < 0.001$). No significant interactions between AmED use and either gender or partner intimacy were found.

Discussion

The objective of the present study was to advance understanding of the relationship between AmED use and sexual risk-taking among young adult college students, with attention to the potential moderating effects of gender and level of partner intimacy. Results of hierarchical logistic regression analyses supported the following conclusions.

First, AmED use was globally associated with at least some forms of sexual risk-taking. AmED users were more likely than nonusers to report intoxication and/or a casual partner at most recent sexual intercourse, even after accounting for the frequency of heavy episodic alcohol use. These results were broadly consistent with previously published studies linking frequent energy drink use, with or without alcohol, to a constellation of problem behaviors (e.g., substance use, fighting, and seatbelt omission)[20–30] and risk-tolerant attitudes (e.g., "Taking dangerous risks helps me to prove myself").[58] The analysis provides the first empirical support for a link between AmED use and indiscriminate sexual behavior (i.e., casual or intoxicated sex). Because these associations remained significant after accounting for frequency of heavy episodic drinking and endorsement of risk-taking norms, they cannot be dismissed as spurious artifacts of social drinking or sensation-seeking. AmED use was associated with an escalation of sexual risk that was not reducible to the effects of alcohol or personality selection effects alone.

Second, sexual risk has multiple dimensions, and the relationships among them are complex. Previous studies have shown that indiscriminate sexual behavior (e.g., casual sex) does not necessarily correspond to a lack of protective behavior (e.g., condom nonuse).[51,53] Consistent with these studies, casual sex was negatively correlated with unprotected sex in the present analyses; that is, young adults were more likely to use a condom when having intercourse with a nonsteady partner. Since unprotected sex with a steady (and thus presumably known and trusted) partner constitutes a lesser risk for adverse consequences than unprotected casual sex, the latter behavior was uniquely of interest in the present analyses. In fact, in unadjusted comparisons (Table 2), participants who reported the highest level of risk (unprotected sex with a casual partner while intoxicated) at most recent intercourse were nearly twice as likely as their lower-risk peers to be AmED users. However, in multivariate analyses controlling for frequency of heavy drinking and endorsement of risk-taking norms, AmED use was not a significant predictor of unprotected sex—even after controlling for the possible moderating effect of level of partner intimacy. That is, past-month AmED use was not associated with an elevated likelihood of condom nonuse at most recent intercourse with either type of partner.

Third, women were significantly less likely to engage in indiscriminate sexual behavior, and more likely to have unprotected sex, than their male peers. Gender differences in self-protective sexual behavior may reflect dyadic power imbalances that limit women's ability to negotiate safer sex,[54] particularly in drinking situations that undermine self-protective strategies.[46,52] While some previous studies have failed to find a significant link between alcohol use and unprotected sex,[17] others have found that the connection between drinking and condom use is to some extent conditioned by gender.[19,54,59] However, in the present analysis, no gender/AmED interaction was found for any of the three sexual risk-taking outcomes; the relationships between AmED use and sexual risk-taking were robust across gender. These findings were unexpected and invite future confirmatory investigation using event-level data.

The findings reported here were subjected to several limitations that invite rectification in future studies. Collectively, these limitations reflect an urgent need for new data collection in this emerging field of research, particularly among noncollege populations. The present sample was drawn from undergraduates enrolled at a single public university in the northeastern United States, restricting its generalizability. While a few studies have examined the implications of AmED or nonalcoholic energy drink use by convenience samples of athletes,[22,60] musicians,[30] or military service personnel,[61] future efforts must expand the reach of AmED research to include probability samples of noncollege young adults, adolescents, and other high-risk populations.

In addition, the broad cross-sectional design of the present study permitted conclusions regarding global associations but not the nature or direction of effects. In the absence of data suitable for assessment of event-level relationships, it was not possible for these analyses to test the extent to which AmED use and sexual risk-taking co-occurred. For example, it is possible that the causal direction of the relationship between AmED use and risky sex operates in reverse of that hypothesized. For some young adults who engage in premeditated sexual risk-taking, AmED use may constitute a conscious strategy to enhance the quality of the sexual experience. Whereas alcohol reduces inhibitions and provides a rationale for otherwise unacceptable promiscuity ("excuse in a bottle"),[62] caffeine provides energy and alertness, reducing the alcohol-induced lethargy[31] that may hamper sexual arousal or performance. In other words, there is a reasonable expectation that AmED use will enhance a sexual experience by simultaneously buffering the physical side effects of alcohol and lowering psychological barriers to casual sex. Therefore, AmED use might be precipitated by the intention to engage in sexual risk-taking. More longitudinal, event-level, and quasi-experimental studies will be needed in order to establish whether AmED use in fact is causal or merely symptomatic of elevated risk for indiscriminate sexual behavior. To date, only a few AmED-related risk studies have employed more sophisticated research designs, and those have focused not on sexual risk-taking but on substance abuse[28,29] or vehicular risk-taking.[24]

Like most extant studies, the data used in these analyses were originally collected in service of a non-AmED-related

research focus; consequently, the measures were somewhat limited for present purposes. AmED use was assessed only in terms of the number of days in the past month on which these substances were used, rather than overall number, quantity, or caffeine dosage of drinks, and did not distinguish between ready-to-drink and mix-your-own formulations. Measures of sexual risk-taking relied on self-reported participant recollection rather than proximal or real-time reporting. Most urgently, no measures were available to assess sex-related or alcohol-related caffeine expectancies. Until expectancy measures are developed and validated for use in future studies, a full-fledged theory of the mechanisms linking AmED use and sexual risk-taking will necessarily remain incomplete. Without knowing what effects or consequences people expect from AmED use, we cannot definitively test whether the relationships between AmED use and indiscriminate sex reflect (1) conscious and proactive decisions made on the basis of sex-related caffeine expectancies, or (2) unintended failures of compensatory vigilance.

Policy implications

The physiological risks of combining alcohol and caffeine are tangible; caffeine masks several of the more obvious symptoms of drunkenness while leaving intact the associated impairments to coordination and reaction time.[32,33,37,42] Compared with alcohol use alone, subjective perceptions of intoxication are more distorted and compensatory adaptive responses typically used by the drinker to minimize self-harm are undermined.[43] The likelihood of excessive drinking and associated health- or safety-compromising outcomes is consequently greater. In contrast, the psychosocial risks are less clear. Emergent research, including the present study, points to links among AmED use, impaired judgement, and risky casual sex, but solid data to assess the nature and direction of the relationships in question remain elusive.

In 2010, highly publicized accounts of college students hospitalized after ingesting large quantities of AmEDs coupled with growing concern from health professionals[63] and policy makers[64] prompted the U.S. Food and Drug Administration to investigate the safety of premixed AmEDs, concluding that caffeine is an unsafe food additive to alcoholic beverages.[65] Upon notification by the Federal Trade Commission that their products were unsafe and could not legally be marketed, the makers of popular AmED brands Four Loko, Joose, Max, and Core, and Moonshot subsequently removed caffeine from their premixed alcohol-based formulations.[66]

Reactions to this public health development must be tempered, however, by recognition that the far more common mix-your-own practice of combining alcohol and energy drinks continues unabated. Red Bull & vodka and Jagerbombs (which combine an energy drink with Jagermeister) are now among the most popular mixed drinks in bars and clubs frequented by college-aged young adults, and the on-line Web site Drink Nation offers more than 400 recipes for energy-drink-based mixed drinks.[67] This trend reflects a widespread lack of awareness of the potential for caffeine to exacerbate the risks of alcohol consumption. There remains a pressing need for health care professionals to partner with both the energy drink and alcohol industries to promote public education at a minimum. Further research is also needed to inform ongoing debate and assess the merits of further regulatory action.

Acknowledgments

This research was supported by grant R21 DA016581 from the National Institute on Drug Abuse (to Kathleen Miller). The author gratefully acknowledges Drs. Grace Barnes, Michael Farrell, Don Sabo, and Merrill Melnick for their assistance with data collection and conceptual refinement.

Author Disclosure Statement

No competing financial interests exist.

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