



Perceived Positive Reinforcements Experienced by College Students When Combining Alcohol and Energy Drinks

Weston S Kensinger, Amanda L Divin*

Department of Health Sciences, Western Illinois University, One University Circle, Macomb, Illinois, USA

Abstract

Combining alcohol with energy drinks has become a common practice among college students. Although much research has focused on expectancies and/or negative consequences of such use, little has examined possible consequences. Because positive consequences may be more predominant than negative consequences when examining the immediate positive reinforcement of drinking behaviors, the role such reinforcement plays in the formation of alcohol abuse and dependence is unknown. Therefore the purpose of this study was to (1) To explore perceived positive reinforcements (PPRs) experienced by drinkers when consuming alcohol-only and combining alcohol with energy drinks and (2) Investigate relationship between PPRs and quantity of drinks.

Methods: A convenience sample of 371, 18-24 year old college students completed an online survey containing demographic questions, quantity/frequency index, and the Positive drinking consequences questionnaire for alcohol-only and combined use.

Results: Combined Users (CUs) reported significantly more PPR(s) than alcohol-only users (AOUs), but reported more PPRs when consuming alcohol-only. PPR(s) did not significantly increase with greater quantities of alcohol in AOUs, but did increase among CUs when consuming alcohol-only and combined drinks.

Conclusions: CU derived significantly more PPR(s) than AOUs, suggesting they hold expectancies and experience outcomes different from those of AOUs. Thus CUs may represent a special population at higher risk for alcohol abuse and dependence. Incorporating PPR(s) into current alcohol treatment and prevention practices represents an unexplored avenue with great potential to transform the college drinking culture.

Keywords: Perceived positive reinforcements; Positive consequences; Combined use; Alcohol and energy drink use; College students

Introduction

Caffeine and alcohol are two of the most historically used and abused substances. The first records of caffeine consumption date back to 2737 BC [1,2], while the history of alcohol use dates back to 6000 BC [3,4]. Today approximately 80-90% of all Americans regularly consume caffeine [5,6] while 52% of Americans ages 12 or older report being current alcohol consumers [7]. Because of their widespread use, addictive nature, and potential (negative) societal affects, a multitude of research has been performed regarding each of these two substances.

Overall results of such research indicate that college students are a special group of both caffeine and alcohol consumers whose prevalence of use easily exceeds that of other age groups. In fact, 89% of college students report caffeine consumption in the past 30 days [8] and 60.8% report being current alcohol drinkers [7]. Although things like coffee, tea, and/or cola have traditionally been the main sources of caffeine, since the introduction of Redbull® in the United States in 1997 [9], energy drinks (EDs) have become increasingly prevalent sources of caffeine, with 25% to 51% of college students reporting regular ED use [10,11]. The practice of combining alcohol with EDs has also become increasingly common among college students [10-14]. Unfortunately, it has also consistently been associated with a variety of dangerous consequences. For example, those who combine alcohol and EDs (combined users; CUs) are more likely to drink greater amounts of alcohol [12,15] and engage in heavy episodic drinking [10,12,15,16] than alcohol only users (AOUs). They underestimate their own level of impairment [15,17], as well as the impairment in others [12], resulting in a diminished ability to assess risk, poor judgment, and subsequent injury [18]. Negative alcohol-related consequences faced by CUs include being more likely to put themselves in physical danger while

drunk [19], experience or commit a sexual assault [10], ride with an intoxicated driver [10,12], and drive home after drinking [12,19,20]. Of even greater concern is that while alcohol consumption increases reaction time (e.g. makes it greater) and the number of errors in performance, when an individual combines alcohol with EDs, caffeine offsets the increase in reaction time, allowing individuals to respond just as quickly as if they were not intoxicated. Although the amount of errors in their performance remains unchanged [21] the alertness may lead individuals to perceive themselves as less intoxicated and/or impaired. This inaccurate assessment of impairment may make CUs an even greater risk to themselves and others [15].

Research examining alcohol expectancies has found that expectations regarding the effects of alcohol are formed long before an individual takes his/her first sip of alcohol [22], and that such expectations significantly affect his/her motivation to drink as well as the actual effects alcohol has on his/her behavior [23-25]. Numerous studies have examined the role that alcohol expectancies have in drinking behavior. Such expectancies are the beliefs that one holds about what will happen if they consume alcohol [26]. Twenty years of research suggest that beliefs about what will happen when consuming

*Corresponding author: Amanda L Divin, Department of Health Sciences, Western Illinois University, One University Circle, Macomb, Illinois, USA, Tel: 309-298-1076; E-mail: A-Divin@wiu.edu

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alcohol (expectancies) are reliably associated with drinking behavior [27]. The more positive alcohol expectancies an individual holds, the more likely it is that he/she will engage in drinking behavior. Studies suggest that higher quantities of drinking (4+ drinks for women, 6+ drinks for men) positively correlate with excitement and more positive expectancies [26]. The expectancies an individual has about drinking may correlate with his/her drinking behavior. In one study individuals who drank heavier amounts on an infrequent basis (binge drinkers) had higher expectations for increased assertiveness and cognitive enhancement. When subjects consumed drinking less alcohol per drinking episode, they reported more negative expectancies [28]. Individuals who exhibit positive alcohol expectancies are associated with heavy drinking, more frequent alcohol use, and associated alcohol related problems [29].

Research examining caffeine expectancies has had similar results [30-32]. Thus an individual's expectancies, combined with the drive to obtain them [33], the desirability of the substance's effects [31,34,35], the pharmacological properties of the drug (alcohol, caffeine, or combination of the two), and an individual's past experiences may provide insight to his/her drinking behaviors [23,30-32].

Although a multitude of research has focused on alcohol and caffeine expectancies, very little has examined positive consequences or outcomes of their use. Whereas expectancies are anticipated, general beliefs that certain types of positive or negative consequences/outcomes are likely to occur as a result of alcohol consumption [23,36,37], perceived positive reinforcements (PPRs) are the actual, real-life positive consequences/outcomes experienced by the individual while drinking alcohol [36]. Those who combine alcohol and EDs (combined users; CUs) do report experiencing more positive consequences or outcomes associated with their combined consumption such as increased wakefulness and energy [16,17,36,38] less mental fatigue, more feelings of stimulation (e.g. elation, energy, stimulated, talkative, up, vigorous instead of; [15], enhanced intensity of a sexual experience [36], fewer headaches, less weakness, decreased dry mouth [17], less mental fatigue [15], and enhanced social interactions [16,36,38]. Consequently, experiencing such positive consequences associated with one's combined use may reinforce the behavior [39,40]. According to addiction experts, PPRs may be a good predictor of an individual becoming psychologically and/or physically dependent on alcohol because when a person believes that he/she needs alcohol to enhance who he/she is (e.g., to be more social) or to help him/her achieve positive outcomes (e.g., better chance with the opposite sex) experiencing such outcomes rewards the drinking behavior thus acting to positively reinforce it [41].

While research on ED consumption and combined use continues to increase, more is needed to fully understand the implications of combined use within the college population. More specifically, it is important that researchers better understand the rationale for combining alcohol and EDs, as well as the actual experiences of the drinker, if successful interventions are to be created to address this potentially deadly behavior. Currently very little research has examined the PPRs experienced by individuals when consuming alcohol [39,40,42-45], and no published research has specifically examined PPRs reported from the combination of alcohol and EDs. Because positive outcomes may be more predominant than negative outcomes, especially when examining the immediate positive reinforcement of drinking behaviors [39,46], and only a limited number of studies have examined the positive consequences of drinking within a college population, the role and extent that such PPR(s) play in drinking

behavior has not been established. This study fills an important gap by not only asking college-aged drinkers about the PPR(s) experienced when consuming alcohol only, but also about the PPR(s) experienced when combining alcohol and EDs.

However, since this study is the first of its kind, we focused on basic elements of PPR(s). More specifically, the aims of the current study were to: (1) examine the PPR(s) experienced by college students when consuming alcohol-only and the combination of alcohol and EDs and (2) explore if differences in PPR(s) exist based on user type and/or gender.

Materials and Methods

Study population

A convenience sample of 18-26 year old college students enrolled in undergraduate courses at Oklahoma State University and/or Northern Oklahoma College were solicited for voluntary participation in this study by professors and teaching assistants. Participants were directed to complete an anonymous and confidential Internet-based online survey asking about their alcohol and ED consumption, as well as the motives for use and perceived effects of both alcohol and the combination of alcohol and EDs. Prior to beginning the study, Institutional Review Board [IRB] approval was obtained from Oklahoma State University, and in accordance with the IRB, informed consent was obtained from all participants prior to participation.

Measures

Demographic characteristics: Participants self-reported their age, sex, ethnicity, and year in school. Information regarding place of residence (on/off campus) and involvement in the Greek system (yes/no) was also collected. Additional factors identified by previous research as influencing alcohol and/or ED use were also collected (e.g. access to alcohol (yes/no), access to EDs (yes/no), and if ever combined alcohol and energy drinks (yes/no)).

Amount and frequency of use: The amount and frequency of use was collected with a Quantity-Frequency Index (QFI). A QFI for use of alcohol only was first completed, with participants answering the following questions: "In the last 30 days, how many occasions have you drank alcohol?", "On average, how many standard alcoholic drinks do you consume on a drinking occasion?", "Over the last 30 days, how many times (if any) have you had five or more drinks in a row?" and "In the past 30 days, what was the greatest number of alcoholic drinks you consumed in a row? Over how many hours did you consume alcohol on this occasion?" The alcohol only QFI clearly defines a drink as a 1.5 ounce of 80 proof liquor (a 'shot'), 12 ounces of beer, or 4-5 ounces of wine, with one 750 ml bottle of 80 proof liquor equaling 17 drinks, and gives a visual image of each.

A QFI for the combined use of alcohol and EDs was then collected with participants answering the following questions: "In the last 30 days, how many occasions have you combined alcohol and energy drinks?", "On average, how many standard alcoholic drinks do you consume on a combined-use drinking occasion?", "On average, how many standard energy drinks (8oz.ED or 2oz. energy shot) do you consume on a combined-use drinking occasion?", "In the last 30 days, how many times have you consumed had 3 or more combined drinks in a row?," "While combining in the last 30 days, what was the greatest number of alcoholic drinks you consumed in a row? Over how many hours did you combine on this occasion?" and "While combining in the last 30 days, what is the greatest number of energy drinks you consumed

in a row? Over how many hours did you combine on this occasion?” The combined use QFI states: “Combined-use is either mixing energy drinks with alcohol or using an energy drink (ED) within plus or minus 2 hours of using alcohol. For example, if you consume energy drinks before going out to the bar, and then start drinking alcohol, this is still considered combined-use,” and then gives the following text next to a visual image of the product: “8 oz of standard energy drinks (Red Bull)=1 Energy Drink”, “2 oz Energy Shot=1 Energy Drink”, “16 oz Standard Energy Drinks (Monster, Full Throttle, Rockstar, etc.)=2 Energy Drinks”, “16 oz (NOS)=3 Energy Drinks” and “8 oz (Spike, Redline)=3 Energy Drinks.”

Perceived positive reinforcement(s): Perceived Positive Reinforcement(s) (PPRs) were measured using a modified version of the Positive Drinking Consequences Questionnaire (PDCQ; [36]). The PDCQ is comprised of 14 questions which ask participants to indicate the number of times they have experienced the specific listed consequences in the last three months, stressing that they only report what actually occurred, not what they had thought to occur. The original PDCQ is scored using a five point interval scale based on the number of times subjects had experienced the consequence (1, 1-2, 3-5, 6-10, >10). Scores on the 14 items are then summed, with a possible range from 14-70, giving an overall measure of PPR for alcohol consumption. In the current study, the response categories were modified to be “(1) Almost never”, “(2) Some of the time”, “(3) Half of the time”, “(4) Most of the time”, and “(5) Almost always”. An overall sum score was calculated for each participant. As with the original PDCQ, higher scores on the modified instrument used in the current study represent experiencing greater PPR(s) of alcohol consumption or combined consumption of alcohol and EDs.

Participants completed two PDCQ’s, one PDCQ based on alcohol only consumption and a separate PDCQ based on the combined consumption of alcohol and EDs.

Data collection

Due to the sensitive nature of the information collected and possible legal consequences of underage alcohol consumption, the use of an anonymous and confidential Internet-based online survey was used to collect data. If participation was desired, participants were directed to a web address to complete the survey which included demographic questions, the alcohol-only QFI, the combined use QFI, the alcohol-only PDCQ, and the combined use PDCQ. Data collection occurred during the fall academic semester of 2009.

Data analysis

All analyses were performed using Statistical Package for Social Sciences SPSS version 16.0. Participants were first categorized for analysis based on their responses to “Do you drink alcohol?” and “Have you combined alcohol and energy drinks?” Those who responded “No” to “Do you drink alcohol?” were classified as non-drinkers and excluded from the final sample.

Those who responded “Yes” to “Do you drink alcohol?” comprised the final sample. Of the final sample, those who responded “No” to “Have you combined alcohol and energy drinks?” were classified as alcohol only users (AOUs), while those who responded “Yes” were classified as combined users (CUs). Mean total scores for the PDCQ were calculated, as were scores for individual items on the PDCQ. Independent samples *t*-tests were used to measure differences in PPR(s) between AOUs and CUs and paired samples *t*-tests were used to measure differences in PPR(s) within the CU group. Pearson product-

moment correlations were calculated to determine the relationship between the average amount of alcohol consumed on one occasion, overall PPR and individual PPR items among CUs. Alpha level was set at $p \leq 0.05$ for all statistical analysis. In the event of missing data, cases were excluded pairwise, meaning they were excluded only from the analyses for which that data was necessary but included in other analyses for which they did provide data.

Results

Demographics

A total of 540 students completed the survey; however this number was reduced to include only participants of traditional college age (18-24) and those who consumed alcohol, leaving a final sample consisting of 371 participants. Table 1 provides a summary of demographic characteristics of the overall sample and separated by gender.

Perceived positive reinforcement(s)

Perceived positive reinforcement(s) among all alcohol users: Table 2 presents the means and standard deviations for the alcohol-only PDCQ as well as alcohol-only PDCQ individual items for the entire sample and separated by gender. The entire sample, which included both AOUs and CUs, had a total alcohol-only PDCQ score of 31.27 ± 10.22 . When separated by gender, the score for males was 32.51 ± 10.82 and the score for females was 30.58 ± 9.91 . Overall alcohol-only PDCQ scores were not significantly different between males and females. However significant differences did exist on three individual items (“I found myself in a frightening situation and I felt surprisingly

Group	Total**	Males	Females
Age			
18-19	135	45	85
20-21	152	43	109
22-23	66	28	38
24-25	8	5	3
Academic Classification			
Freshman	98	40	54
Sophomore	82	28	53
Junior	77	19	58
Senior	106	39	67
Graduate Student	7	2	5
Race			
White/Non-Hispanic	312	108	200
African American	15	4	11
Hispanic	17	7	10
Asian/Pacific Islander	3	1	1
American Indian	16	6	10
Other	6	1	5
Current Living Arrangement			
On Campus	129	46	80
Off Campus	236	79	155
Greek Membership			
Yes	84	22	61
No	260	96	160
Combined Alcohol and Energy Drinks			
Yes	195	72	123
No	170	56	114

*Includes only participants reporting alcohol consumption

**Number does not equal number appearing in 'Total' column owing to non-response

Table 1: Demographic Characteristics of Final Sample*.

fearless”, “I found a creativesolution to a problem I might otherwise have had difficulty solving”, and “The intensity of a sexual experience was enhanced”) with males scoring significantly higher than females. These findings suggest that males who consume alcohol may experience greater PPRs from their alcohol use than females; and when males consume alcohol they experience significantly greater reinforcement from their alcohol use when it comes to feeling fearless, being creative, and/or experiencing greater intensity of a sexual encounter.

Table 3 presents the means and standard deviations for the alcohol-only PDCQ as well as alcohol-only PDCQ individual items for all alcohol users separated by AOU and CU. An independent *t*-test found a statistically significant difference in PPR between CUs (*M*=32.91, *SD*=10.13) and AOU (*M*=29.35, *SD*=10.00); *t* (352)=3.30, *p*<0.001 (two-tailed). CUs scored higher on the alcohol-only PDCQ than the AOU, suggesting that CUs derived more overall PPR than AOU. When examining individual items of the alcohol-only PDCQ, CUs scored significantly higher on the items “I approached a person that I probably wouldn’t have spoken to otherwise”, “I revealed a personal feeling or emotion that I had previously kept secret”, “I felt like I had enough energy to stay out all night partying or dancing”, “I

found myself in a frightening situation and I felt surprisingly fearless”, “I felt especially confident that other people found me attractive”, “The intensity of a sexual experience was enhanced”, “On a particularly stressful day, I noticed a release of tension from my muscles and nerves” and “Things that I had been worrying about all day no longer seemed important”. Higher scores on these items by CUs suggests that CUs perceive significantly greater reinforcement from their alcohol use than AOU, and that alcohol use enables them to be more outgoing, open with their emotions, energetic, fearless, and attractive, experience greater intensity during a sexual encounter, and reduced tension and worries.

Perceived positive reinforcement(s) among combined users:

Table 4 presents the means and standard deviations for the combined use PDCQ as well as combined use PDCQ individual items for all CUs. Participants in this analysis were limited to those who were CUs (*n*=184). The total combined use PDCQ score among CUs was 25 ± 13.12. When separated by gender, the score for males was 26.53 ± 14.49 and the score for females was 24.09 ± 12.12. Overall combined use PDCQ scores were not significantly different between male and female CUs (*t*(182)=1.22, *p*<0.223 (two-tailed)). However significant

Individual Item from PDCQ	Total Sample	Male	Female
“I approached a person that I probably wouldn’t have spoken to otherwise”	2.57 ± 1.11	2.54 ± 1.05	2.59 ± 1.15
“I told a funny story or joke and make others laugh”	2.71 ± 1.18	2.76 ± 1.23	2.68 ± 1.15
“I revealed a personal feeling or emotion that I had previously kept secret”	2.07 ± 1.03	2.10 ± 1.00	2.04 ± 1.04
“I felt like I had enough energy to stay out all night partying or dancing”	2.63 ± 1.21	2.69 ± 1.20	2.57 ± 1.20
“In a situation in which I would usually have stayed quiet, I found it easy to make conversation”	2.80 ± 1.13	2.83 ± 1.11	2.79 ± 1.17
“I stood up for a friend or confronted someone who was in the wrong”	2.21 ± 1.14	2.28 ± 1.15	2.17 ± 1.14
“I found myself in a frightening situation and I felt surprisingly fearless”	1.73 ± 1.03	1.94 ± 1.09**	1.61 ± 0.91
“I found a creative solution to a problem I might otherwise have had difficulty solving”	1.77 ± 0.941	1.97 ± 0.98**	1.65 ± 0.91
“I felt especially confident that other people found me attractive”	2.22 ± 1.10	2.32 ± 1.14	2.17 ± 1.09
“The intensity of a sexual experience was enhanced”	2.25 ± 1.23	2.48 ± 1.25*	2.13 ± 1.21
“I acted out a sexual fantasy that I might ordinarily be embarrassed to reveal or attempt”	1.78 ± 1.08	1.90 ± 1.18	1.70 ± 1.02
“On a particularly stressful day, I noticed a release of tension from my muscles and nerves”	2.27 ± 1.15	2.35 ± 1.15	2.23 ± 1.13
“Something that would have ordinarily made me upset or emotional didn’t really get me down”	1.92 ± 0.989	2.02 ± 1.04	1.85 ± 0.95
“Things that I had been worrying about all day no longer seemed important”	2.40 ± 1.194	2.41 ± 1.18	2.39 ± 1.20
Overall Total Score	31.27 ± 10.22	32.51 ± 10.82	30.58 ± 9.91

***p*<.01; **p*<.05

Table 2: Mean ± Standard Deviation for Overall Perceived Positive Reinforcement and Individual Perceived Positive Reinforcements in Total Sample and Separated by Gender.

Individual Item from PDCQ	Alcohol-Only Users	Combined Users
“I approached a person that I probably wouldn’t have spoken to otherwise”	2.40 ± 1.09**	2.74 ± 1.11
“I told a funny story or joke and make others laugh”	2.61 ± 1.13	2.80 ± 1.21
“I revealed a personal feeling or emotion that I had previously kept secret”	1.90 ± 0.94**	2.21 ± 1.07
“I felt like I had enough energy to stay out all night partying or dancing”	2.38 ± 1.18**	2.82 ± 1.20
“In a situation in which I would usually have stayed quiet, I found it easy to make conversation”	2.79 ± 1.23	2.82 ± 1.07
“I stood up for a friend or confronted someone who was in the wrong”	2.14 ± 1.134	2.27 ± 1.15
“I found myself in a frightening situation and I felt surprisingly fearless”	1.57 ± 0.94**	1.85 ± 1.08
“I found a creative solution to a problem I might otherwise have had difficulty solving”	1.66 ± 0.85	1.84 ± 1.00
“I felt especially confident that other people found me attractive”	2.09 ± 1.08*	2.33 ± 1.12
“The intensity of a sexual experience was enhanced”	2.09 ± 1.21*	2.39 ± 1.25
“I acted out a sexual fantasy that I might ordinarily be embarrassed to reveal or attempt”	1.66 ± 1.03	1.88 ± 1.12
“On a particularly stressful day, I noticed a release of tension from my muscles and nerves”	1.98 ± 1.02**	2.52 ± 1.18
“Something that would have ordinarily made me upset or emotional didn’t really get me down”	1.82 ± 0.94	1.99 ± 1.01
“Things that I had been worrying about all day no longer seemed important”	2.24 ± 1.15*	2.54 ± 1.21
Overall Total Score	29.35 ± 10.00**	32.91 ± 10.13

***p*<.01; **p*<.05

Table 3: Mean ± Standard Deviation for Overall Perceived Positive Reinforcement and Individual Perceived Positive Reinforcements in Alcohol-Only Users and Combined Users.

differences were found on one individual combined use PDCQ item (“I found myself in a frightening situation and I felt surprisingly fearless”), with males scoring significantly higher than females. These findings suggest that although overall PPR from combined use does not differ between males and females, males experience greater positive reinforcement for their combined use when it comes to fearlessness.

Table 5 presents the means and standard deviations for the alcohol-only PDCQ, combined use PDCQ, and individual items of both PDCQs for all CUs. A paired-samples *t*-test found a statistically significant difference in the alcohol-only PDCQ scores ($M=32.91$, $SD=10.29$) and combined use PDCQ scores ($M=25.06$, $SD=13.12$); $t(180)=8.24$, $p<0.000$ (two-tailed) for CUs. This finding suggests that CUs derive more overall PPR from consuming alcohol alone rather than combining alcohol and EDs. Analysis of individual PDCQ items revealed that for all PPRs listed, CUs also experienced greater reinforcement when consuming alcohol-only rather than combining it with EDs.

Discussion

Consistent with previous research [39,40,42-45], drinkers did indeed experience ‘positive consequences’ or PPR(s) when consuming alcohol. The current study, however, extends the body of knowledge by (1) examining and comparing the PPR(s) experienced in two different types of drinkers (those who consumed alcohol only (AOUs) and those who combined alcohol and EDs (CUs)) and (2) comparing the PPR(s) experienced by CUs when consuming alcohol-only and combining alcohol with EDs. Results from the current study suggest CUs experienced significantly greater overall PPR than AOUs, both when they [CUs] consumed alcohol-only beverages and when they combined alcohol and EDs. Individual item analysis revealed that during alcohol-only consumption, CUs experienced the specific PPRs of being more outgoing, feeling more open with emotions, feeling energetic, fearless, and attractive, having an enhanced sexual experience, and experiencing a reduction of tension and worries at significantly greater amounts

Individual Item from PDCQ	All Combined Users	Males (N=67)	Females (N=117)
“I approached a person that I probably wouldn’t have spoken to otherwise”	1.92 ± 1.18	1.91 ± 1.15	1.93 ± 1.21
“I told a funny story or joke and make others laugh”	1.91 ± 1.17	1.97 ± 1.17	1.88 ± 1.18
“I revealed a personal feeling or emotion that I had previously kept secret”	1.63 ± 0.98	1.77 ± 1.07	1.54 ± 0.92
“I felt like I had enough energy to stay out all night partying or dancing”	2.22 ± 1.43	2.18 ± 1.34	2.24 ± 1.47
“In a situation in which I would usually have stayed quiet, I found it easy to make conversation”	1.96 ± 1.94	2.07 ± 1.19	1.91 ± 1.21
“I stood up for a friend or confronted someone who was in the wrong”	1.78 ± 1.16	1.97 ± 1.29	1.67 ± 1.08
“I found myself in a frightening situation and I felt surprisingly fearless”	1.61 ± 1.05	1.87 ± 1.22	1.46 ± 0.91
“I found a creative solution to a problem I might otherwise have had difficulty solving”	1.55 ± 0.91	1.68 ± 1.03	1.47 ± 0.83
“I felt especially confident that other people found me attractive”	1.72 ± 1.06	1.82 ± 1.15	1.66 ± 1.00
“The intensity of a sexual experience was enhanced”	1.74 ± 1.14	1.87 ± 1.26	1.65 ± 1.58
“I acted out a sexual fantasy that I might ordinarily be embarrassed to reveal or attempt”	1.58 ± 1.04	1.73 ± 1.14	1.47 ± 0.95
“On a particularly stressful day, I noticed a release of tension from my muscles and nerves”	1.82 ± 1.18	1.86 ± 1.20	1.78 ± 1.15
“Something that would have ordinarily made me upset or emotional didn’t really get me down”	1.68 ± 1.04	1.77 ± 1.15	1.61 ± 0.97
“Things that I had been worrying about all day no longer seemed important”	1.82 ± 1.15	1.79 ± 1.16	1.83 ± 1.14
Overall Total Score	25 ± 13.12	26.53 ± 14.49	24.09 ± 12.12

* $p<0.05$

Table 4: Mean ± Standard Deviation for Overall Perceived Positive Reinforcement and Individual Perceived Positive Reinforcements in Combined Users, Separated by Gender.

Individual Item from PDCQ	Consume Alcohol-Only	Consume Alcohol and Energy Drinks
“I approached a person that I probably wouldn’t have spoken to otherwise”	2.74 ± 1.11***	1.92 ± 1.18
“I told a funny story or joke and make others laugh”	2.80 ± 1.21***	1.91 ± 1.17
“I revealed a personal feeling or emotion that I had previously kept secret”	2.21 ± 1.07***	1.63 ± 0.98
“I felt like I had enough energy to stay out all night partying or dancing”	2.82 ± 1.20***	2.22 ± 1.45
“In a situation in which I would usually have stayed quiet, I found it easy to make conversation”	2.82 ± 1.07***	1.96 ± 1.94
“I stood up for a friend or confronted someone who was in the wrong”	2.27 ± 1.15***	1.78 ± 1.16
“I found myself in a frightening situation and I felt surprisingly fearless”	1.85 ± 1.08***	1.61 ± 1.05
“I found a creative solution to a problem I might otherwise have had difficulty solving”	1.84 ± 1.00***	1.55 ± 0.91
“I felt especially confident that other people found me attractive”	2.33 ± 1.12***	1.72 ± 1.06
“The intensity of a sexual experience was enhanced”	2.39 ± 1.25***	1.74 ± 1.14
“I acted out a sexual fantasy that I might ordinarily be embarrassed to reveal or attempt”	1.88 ± 1.12***	1.58 ± 1.04
“On a particularly stressful day, I noticed a release of tension from my muscles and nerves”	2.52 ± 1.19***	1.82 ± 1.18
“Something that would have ordinarily made me upset or emotional didn’t really get me down”	1.99 ± 1.01***	1.69 ± 1.04
“Things that I had been worrying about all day no longer seemed important”	2.54 ± 1.21***	1.82 ± 1.15
Overall Total Score	32.91 ± 10.29***	25 ± 13.12

*** $p<.0001$

Table 5: Mean ± Standard Deviation for Overall Perceived Positive Reinforcement and Individual Perceived Positive Reinforcements in Combined Users-Comparison of Alcohol-Only and Combined Consumption.

than AOU. These results suggest CUs are a unique subset of drinkers among the college drinking population, as their perception of alcohol experience(s) are more reinforcing than those of AOU. These findings are important because when college students hold positive expectancies for alcohol use and actually experience positive outcomes as a result of this use, the positive drinking experiences/outcomes reinforce the positive expectancies, which then causes students to experience further positive experiences/outcomes, resulting in a positive feedback cycle [39,44]. Thus experiencing such PPR(s) may encourage CUs to drink more often, at higher quantities, and for different reasons than AOU.

Among CUs, one surprising finding emerged when comparing PPR(s) experienced during alcohol-only use and PPRs experienced during combined use. Our results suggest CUs experienced significantly greater overall PPR when consuming alcohol-only rather than when combining. Moreover, when comparing individual PPRs, CUs also experienced significantly greater PPRs when consuming alcohol-only. This finding is very interesting, because although it has been hypothesized that individuals may combine alcohol and EDs to blunt negative effects of alcohol [47], increase pleasurable aspects of alcohol [15], decrease effects of a hangover [48], or allow the drinker to manage his/her subjective experience of intoxication [49], in the current study, CUs choose to combine alcohol and EDs even though they reported experiencing greater PPR(s) when consuming alcohol-only. It begs the question, why would CUs combine if they find alcohol alone more reinforcing? These results suggest there are factors not measured in the present study which influence the decision to drink alcohol-only or to combine it with EDs. For example the current study did not look at the social or cultural environment and/or peer groups of participants. Kuntsche and Stewart [50] and Kuntsche et al. [51] found that drinkers conform to the standards and peer pressure of those around them. Thus participants may be inclined to choose one beverage over another or to drink for different reasons based upon their peer group or social environment. Further research should explore such factors and the role they may play in combined-use drinking behavior [50,51].

The current study also examined if differences in PPR(s) existed based on gender. Although no significant difference in overall PPR was found between all alcohol consuming males and females in the study, males reported experiencing significantly greater amounts of the specific PPRs of feeling fearless, being creative, and having an enhanced sexual experience. When further examining PPR(s) among only CUs, no significant difference was found between males and females, although males did report experiencing significantly greater PPR in regard to feeling fearless. Previous research examining the role of gender in PPR(s) has produced mixed results [39,40,52]. More research is needed to uncover if this is a special case within our sample, or if when looking at gender within CUs, males and females experience identical PPR(s) when combining. Our results do, however, echo those of Park [39] in that generally speaking males and females are more alike in their experiences of PPR(s).

Our findings regarding the relationship between PPR(s), quantity of drinks, and type of drinks were also somewhat surprising. Among AOU overall PPR did not increase with increasing number of drinks, but among CUs, whether consuming alcohol-only or combining alcohol and EDs, it did. This suggests that variables other than PPR, which were not measured in the current study, may contribute to the drinking behaviors of CUs. Previous studies have identified personality factors such as sensation seeking [19,53,54], risk-taking [20,55], and sexual risk taking [56] as correlates to ED consumption. Perhaps such underlying traits may contribute to the initial desire to

consume EDs, and subsequent desire to combine alcohol and EDs. They may also somehow impact the drinking experience causing CUs to derive significantly greater overall PPR from any drinking experience, whether it involves alcohol-only or the combination of alcohol and EDs. The positive relationship between overall PPR, as well as each individual PPR, among CUs when combining alcohol and EDs, and quantity of drinks suggests that the addition of EDs to the drinking experience makes it significantly more reinforcing. Unfortunately the significantly greater amount of PPR(s) experienced with increasing quantity of beverages by CUs is troubling, as it may potentially lead to more episodes of binge drinking as well as more long-term negative consequences [42,45]. Further, although heavy alcohol drinkers may become more accurate at predicting their own alcohol-related consequences [44], the addition of EDs reduces the perception of intoxication [17], desensitizes the drinker to alcohol's negative [47] or sedating [57] effects, enables the drinker to stay awake longer to consume more alcohol [58], and increases the rewarding aspects of alcohol consumption [15]; all things which may contribute to increased quantity of alcohol consumed, formation of positive expectancies, occurrence of positive experiences, overestimation of positive and underestimation of negative consequences of alcohol, and perpetuation of the alcohol abuse cycle [39,40,44]. Overall, these findings suggest CUs are a special population of drinkers who may hold a different perspective and experience when drinking, and thus require a different type of alcohol prevention and treatment programs than AOU.

Limitations

Although the current study had many noteworthy findings, it is not without limitations. First, the current study used a convenience sample and cross-sectional data, thus a causal relationship cannot be determined. Additionally, due to the sensitive nature of the questions, sampling bias may have occurred, and data may underestimate the true prevalence of risky or undesirable behaviors. Efforts were made to minimize the sampling bias by using an anonymous web-based survey which participants could complete in private without the risk of legal ramifications. However the finding(s) regarding participants reporting increased positive reinforcement from the combination of alcohol and EDs is consistent with other studies which have examined alcohol [39,40] or EDs individually [59,60]. Second, approximately 54% of the sample who consumed alcohol reported being a CU. This is within the wide range of prevalence reported in the literature, although the sample was comprised of mainly Caucasian female college students, which limits the general ability. However, the large majority of research examining CU has found that CUs are more likely to be Caucasian and young [10], even among community samples [61]. Future research should include a larger, more diverse sample of college students, with participants from a variety of ethnic backgrounds, educational institutions including both private and public colleges and universities in different geographical regions, and a better balance of gender. It should also include other potential confounding and/or contributing factors other than demographics, such as social/cultural environment, peer groups, and/or personality factors, as potential influences to drinking behavior. Fourth, unfortunately no valid and reliable instrument currently exists which specifically examines combined-use in any capacity. The PDCQ, used in this study to measure PPR(s), was originally designed to measure alcohol-only use. While it showed acceptable reliability in our study ($\alpha=0.97$), development of instruments specifically examining combined-use is necessary to provide more accurate results which may be more sensitive to characteristics of this population.

Conclusions and recommendations for future research

While a large body of research has examined alcohol use in college students and a growing body of research has examined alcohol and ED use, our study is the first to examine and compare the PPR(s) experienced in AOU(s) and CUs. It is further strengthened by examining the PPRs experienced by CUs under two conditions: when consuming alcohol-only and when consuming alcohol and EDs. Our results suggest CUs are a different type of drinker than AOU(s). More specifically, CUs derive significantly greater PPR(s) from their drinking experiences, whether they consume alcohol-only or the combination of alcohol and EDs.

It has been suggested that PPR(s) be examined as an effective tool to help drinkers move toward healthier behaviors [36]. The findings of the present study support this suggestion and have important implications for researchers, public health workers, university administrators, policymakers, and the general public. Researchers should place increased focus on examining the combination of alcohol and any type of caffeine containing beverage, specifically comparing CUs and AOU(s). This research will generate knowledge to assist educators and public health workers not only to educate college students on the many potential risks of combined use, but also how to differentiate between a “wide-awake drunk” and someone who is safe to conduct him/herself without assistance. Our findings also suggest CUs hold expectancies and experience outcomes different from those of AOU(s). Thus they may require different messages or techniques. Future prevention, education, and treatment programs should be developed using intervention strategies such as Self-Determination-Theory or Motivational Interviewing, which recognize the importance of utilizing a individual’s past experiences (e.g. PPR(s)) and motivations to help him/her better foster an environment where health behavior change can be found. These strategies should be tailored to the unique needs and fallacious PPR(s) of CUs. Future prevention, education, and treatment programs should also utilize social norm campaigns to educate CUs about the realities of combined use. These should include both injunctive and behavioral norms to help change the peer culture [62].

Such programs may not help CUs to realize that their drinking view point and behavior are not typical of others, nor are the perceptions experienced while drinking. Because ED companies often use ‘student managers’ to distribute free samples of EDs on campus as well as to gather information about the campus culture to better tailor marketing efforts [10], university administrators may use this research to develop policies regarding the promotion and advertising of EDs on campus and at institutional events. Further, policy makers may wish to consider and reference this research when discussing potential advertising, labeling, and ingredient requirements of EDs and caffeinated alcoholic beverages, as false advertising claims such as “gives you wings”[®] may contribute to the fallacious perceptions reported by CUs.

Given the growing popularity of EDs, the unending use of alcohol by college students, the increasing consumption of combined beverages, and the known potentially negative consequences of such consumption, it is vital to understand the similarities and differences in college students who choose to consume alcohol-only and those who engage in combined-use in order to develop effective interventions. This study is one of the first to suggest that CUs are different from AOU(s) on a variety of levels. Our findings are a critical first step toward conceptualizing why these two groups engage in drinking behaviors. However PPRs must still be investigated further. The role they play in the formation of alcohol expectancies, outcomes, and habits, as well as

what they reveal about the addictive nature of both alcohol and caffeine represent an area of untapped unlimited potential for the prevention and treatment of alcohol-related and other addictive disorders.

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