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Motives for mixing alcohol with energy drinks and other non-alcoholic beverages and its effects on overall alcohol consumption among UK students

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ABSTRACT

Introduction: A UK student survey examined the motivations for consuming energy drinks alone and mixed with alcohol, and aimed to determine whether the type of motive had a differential effect on overall alcohol consumption.
Methods: The online survey (N = 1873) assessed alcohol consumption and motivations for consumption when mixed with energy drinks (AMED) and mixed with other non-alcoholic beverages (AMOB) using a within-subject design.
Results: The most frequent neutral motives reported for AMED consumption included "I like the taste" (66.5%), and "to celebrate a special occasion" (35.2%). 52.6% of AMED consumers reported consuming AMED for at least one of five negative motives, primarily "to get drunk" (45.6%). Despite these negative motives those students reported consuming significantly less alcohol and fewer negative alcohol-related consequences on AMED occasions compared to alcohol-only (AO) occasions. Although the motives for consuming AMED and AMOB were comparable, more participants reported consuming AMED "to celebrate a special occasion", "to get drunk", because they "received the drink from someone else" or "because others drink it as well". However, significantly more students reported consuming AMOB than AMED because "It feels like I can drink more alcohol". Alcohol consumption was significantly less on AMED occasions compared to AMOB occasions, and both occasions significantly less than AO occasions.
Conclusion: The majority of reasons for consuming AMED relate to neutral motives. Although 52.6% of students reported one or more negative motives for AMED consumption (predominantly "to get drunk") this had no differential effect on total alcohol consumption. The differences in motives suggest AMED is consumed more to enjoy special occasions and as a group-bonding experience, however alcohol consumption is significantly lower on such occasions in comparison to when AMOB or AO are consumed.

1. Introduction

The prevalence of energy drink consumption worldwide has increased significantly in the past decade. Within the UK, energy drinks are the fastest growing sub-sector of the soft drinks market, worth over £1.4 billion annually (British Soft Drinks Association, 2014). As the sale of energy drinks has increased so has the popularity of consuming alcohol mixed with energy drinks (AMED), especially among young adults. Differing prevalence rates for AMED consumption among University students have been reported worldwide. For example, among college students in the US prevalence rates ranged from 15 to 24% for AMED consumption in the past month (O'Brien, McCoy, Rhodes, Wagoner, & Wolfson, 2008; Velazquez, Poulos, Latimer, & Pasch, 2012). Despite the continued growth of the energy drinks market and subsequent proliferation of brands increasing consumer choice, to date no research has reported on AMED prevalence within the UK.

The popularity of AMED consumption within the UK has led to public health concerns regarding its use (Drinkaware, 2014; National Health Service, 2014). Some researchers have suggested

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that AMED consumption increases overall alcohol consumption and the likelihood of engaging in negative alcohol-related consequences (Berger, Fendrich, Chen, Arria, & Cisler, 2011; Snipes & Benotsch, 2013; Thombs et al., 2010). However, the majority of research supporting these conclusions has used between-subjects designs, comparing AMED consumers with alcohol-only (AO) consumers. The problem of using a between-subjects design is that the two groups may differ from each other across a number of variables that may explain the observed differences in the frequency and quantity of alcohol consumed (de Haan, de Haan, van der Palen, Olivier, & Verster, 2012). Indeed, between-subjects research has demonstrated that AMED consumers have higher levels of sensation-seeking and risk-taking behaviours, compared to AO consumers (Arria et al., 2010, 2011; Berger et al., 2011; de Haan, de Haan, Olivier, et al., 2012; de Haan, de Haan, van der Palen, Olivier, & Verster, 2012; Miller, 2008; Snipes & Benotsch, 2013). Therefore compared to AO consumers they are more likely to engage in behaviours, such as alcohol and drug use, that are more akin to a risk-taking personality, potentially explaining the differences observed in the between-subjects research. In order to determine whether mixing alcohol with energy drinks plays a role in effecting overall alcohol consumption, studies that utilise a within-subjects design are required. By comparing alcohol consumption on AMED occasions with other occasions on which the same individuals consume AO, pre-existing differences between individuals or groups, such as personality and risk-taking propensity, are controlled for. The current studies that have adopted this design have yielded contrasting findings. Brache and Stockwell (2011) found that, when controlling for inherent personality variables such as risk-taking, students reported consuming more alcoholic beverages on a typical drinking occasion where they were consuming AMED than on a typical drinking occasion where they were not consuming energy drinks. Similarly Peacock, Bruno, and Martin (2012) also reported significantly greater alcohol intake in AMED versus alcohol sessions within-subjects. However, although statistically significant, as noted by the authors the differences in alcohol consumption levels across the two drinking occasions were not considered clinically meaningful. The only other study (Price, Hilchey, Darredeau, Fulton, & Barrett, 2010) that found clinically meaningful increases in alcohol consumption on AMED occasions compared to AO occasions was underpowered (N = 9), In contrast, more robust within-subjects surveys (de Haan, de Haan, Olivier, et al., 2012; de Haan, de Haan, van der Palen, et al., 2012; Woolsey, Waigandt, & Beck, 2010) have found significantly less alcohol consumption on AMED occasions compared to AO occasions. For example, Woolsey et al. (2010) found that when reporting on the greatest number of alcoholic drinks consumed on a single occasion in the past year, the AMED group reported significantly less alcohol consumption (10.83 drinks) when combining alcohol with energy drinks compared with a session of alcohol without energy drinks (18.23 drinks), a reduction of 41%. Therefore, the latter findings suggest that the between subjects differences in alcohol consumption between those who consume AMED and those who consume AO do not appear to be driven by the addition of energy drinks to alcohol but by pre-existing differences between the groups.

Conversely, there may be other reasons that can explain the differences in alcohol consumption and engagement in negative alcohol-related consequences, such as the motivations underlying the decision to consume AMED. However, until now there has been limited research on AMED motives. Importantly, following a call for additional research (Marczinski, 2011) there has been a recent shift within the AMED research community to investigate motivations for AMED use and their potential influence on alcohol consumption and negative outcomes.

One of the first studies to investigate motives for AMED consumption was conducted by O'Brien et al. (2008). Of the 24% of American students that reported consuming AMED, 55% did so to "hide the flavour of alcohol". Other reasons were reported by 41%, including "it was being served at a party", "it was the only mixer available" and "that's how you make a Jager bomb". A minority of students reported a number of negative motives for consuming AMED. These included "to drink more and not feel as drunk" (15%), "not to get a hangover" (7%) and "to drink more and not look as drunk" (5%).

Investigating motivations in regular AMED consumers Marczinski (2011) found that, on a Likert scale ranging from 1 (highly disagree) to 4 (highly agree), the highest agreement motivations were "I like the taste" (3.02), "to celebrate" (3.00), "to socialise" (2.95) and "to get drunk" (2.82). However, a relatively small (N = 66) sample size of AMED consumers was used.

In a Canadian sample, Brache, Thomas and Stockwell (2012) found that the most common reasons for AMED use were because students enjoyed the taste (35%) and to get an energy boost while drinking (27.7%). Other reported reasons included "to stay awake when drinking" (20.2%), "to party longer" (18.4%) and "to hide the flavour of alcohol" (18.1%). Using a qualitative methodology, Jones and Barrie (2009) found similar rationales for AMED consumption among an Australian sample including to extend their nights out and to have more energy to party longer. The focus groups also identified that AMED consumption is used as a group-bonding experience to make nights out more enjoyable.

An Australian study by Peacock, Bruno, and Martin (2013) used focus groups and an extensive literature search to develop 30 reasons that motivated participants to consume AMED. Motives from 403 AMED users were collected via an online survey and grouped into different theme areas using exploratory factor analysis. The primary motives for AMED consumption based on this analysis were improved functionality motives, with 70% of participants reporting consuming AMED to "feel more energetic" and 54% to "stay out later". Taste and sensation motives were also highly endorsed (69%) including "because I like the taste of alcohol and energy drinks together". Other frequently reported motives were situational ("because they are the ingredients in a drink e.g. Jager bomb" 72%, and "sharing AMED with drinking companions" 53%) and hedonistic motives ("to have more fun" 46%, "to get more drunk" 32%). Fewer participants reported consuming AMED for intoxication/impairment motives including "so I could drink more" (20%), "to feel less drunk" (12%), "to look less drunk" (8%) and "to avoid getting a hangover" (6%).

A more recent study by Droste et al. (2014) identified 4 groups of motivational constructs that showed differential associations with alcohol harms. Specifically it was found that those who consumed AMED for hedonistic motives were at increased risk of negative outcomes, including heavier ED consumption during AMED episodes, risk of alcohol dependence, alcohol-related injury and aggression. Intoxication—reduction motives were also significantly associated with experiencing alcohol-related injury, but not with heavier AMED consumption patterns or risk of alcohol dependence.

A large scale Dutch survey (de Haan, de Haan, Olivier, & Verster, 2012; Verster, Benson, & Scholey, 2014) recently found similar findings to the majority of previous research in that the most frequently reported motives for consuming AMED were "I like the taste" (81.1%), "I wanted to drink something else" (35.3%) and "to celebrate a special occasion" (14.6%). When the reported motives were categorised into neutral or negative motives, it was found that a minority (21.6%) of students reported at least one of the five negative motives for consuming AMED. However, despite these negative motives, within-subject comparisons revealed that alcohol consumption and negative alcohol-related consequences

were significantly lower on AMED occasions compared to AO occasions. Hence, in contrast to Droste et al. (2014) the type of motive (neutral or negative) had no differential effect on total alcohol intake. An important advantage of this survey was that it made direct comparisons between the motives for consuming AMED and those for consuming alcohol mixed with other non-alcoholic beverages (AMOB). This is of importance given that energy drinks are a relatively new mixer option and are not generally the first choice mixer. Interestingly, no relevant differences in drinking motives and overall alcohol consumption were found between occasions on which students consumed AMED or AMOB suggesting that energy drinks are not unique from the many other mixers consumers can choose from.

In summary, although the outlined studies report on a wide range of motives across a variety of geographies, the primary reasons for consuming AMED appear to be related to consumers appreciation of AMED taste, and expectations regarding the positive effects of the drinks functional ingredients, such as providing energy and to extend nights out. Importantly, the belief that AMED consumption increases overall alcohol intake is not supported by the motives given by the consumers themselves, with relatively few students reporting consuming AMED in order to drink more alcohol. In addition, there is mixed findings as to whether certain types of motives are associated with increased alcohol consumption and increased risk of negative outcomes.

Given the public health concerns on AMED consumption in the UK, the lack of available data and the wide variety in reported prevalence and motives given for consuming AMED in different countries, a replication of the Dutch student survey (de Haan, de Haan, Olivier, et al., 2012; de Haan, de Haan, van der Palen, et al., 2012; Verster et al., 2014) was conducted among UK students. The aim of the study was to examine the motives reported by UK students for consuming energy drinks, both alone and mixed with alcohol. In addition, the study aimed to determine whether, among those who reported negative motives for consuming AMED, there was a difference in alcohol consumption on occasions they consumed AO with occasions they consumed AMED, using a within-subjects design. Lastly, motives and alcohol consumption patterns were compared when mixing alcohol with energy drinks and other non-alcoholic beverages.

2. Methods

2.1. Sample

UK university student unions (N = 139) were contacted via email and asked if they would be willing to advertise the AMED student survey via their social media platforms. In total 30% of student unions, including institutions from each country (England, Wales, Scotland, Northern Ireland) responded and agreed to disseminate a short summary of the surveys content and web link. Prior to commencing the study ethical approval was granted by the University of the West of England ethics committee. On opening the link participants were informed of the purpose and content of the survey, and were told that participation was anonymous and voluntary. Upon completion of the study, participants were offered the opportunity to be entered into a prize draw (1 × £500, 10 × £50). Entrance to the survey required participants to provide an email address. To ensure anonymity, the email address provided was not linked to the participant's survey responses.

A total of 2371 respondents opened the link to the survey; however 498 were excluded from data analysis due to not meeting the same inclusion criteria applied in previous research (de Haan, de Haan, Olivier, et al., 2012; de Haan, de Haan, van der Palen, et al., 2012; Verster et al., 2014). Among these, 7 participants did not agree to participate in the study after reading the informed consent page, 78 were outside the age range of the target energy drink market (1 was younger than 18 years, 77 were older than 30 years), and 211 participants did not answer the questions that were necessary to classify them as part of one of the drinking groups. Finally 10 participants stated that they did not answer the questions truthfully and 192 were non-students. Therefore the valid, complete dataset is based on 1873 participants.

3. Survey questions

Following informed consent, demographic data and participants' medication, smoking and drug use, as well as educational status (University, level of study, full/part-time) and membership to University society/sports group were assessed.

Standardised consumption questions, adapted from the Quick Drinking Screen (Roy et al., 2008; Sobell et al., 2003), then assessed consumption habits (frequency and quantity) across differing timescales (one occasion, 30 days, 12 months) considering the particular drink in question. If applicable, the standardised consumption questions (listed in Table 1) were asked for consuming energy drinks, AO, AMED and AMOB. Participants were asked whether they consumed the particular beverage in question (i.e. do you consume energy drinks? or do you consume alcohol?) and were therefore considered current consumers. Within this study, alcohol consumption was defined using standardised UK alcohol units (1 standard unit = 10 mg of pure alcohol) (National Health Service, 2013) and one energy drink standardised to 250 ml. With regards to mixing alcohol with other non-alcoholic beverages, participants had the choice of a wide range of mixers that are popular in the UK to choose the one mixer they usually preferred. They could also state their own preferred mixer if this was not available in the list of mixers provided. Participants then completed the consumption questions concerning their chosen preferred mixer. In line with previous research (de Haan, de Haan, Olivier, et al., 2012; de Haan, de Haan, van der Palen, et al., 2012; Verster et al. 2014) mixing on both AMED and AMOB occasions was defined as consuming the mixer (ED or other chosen non-alcoholic beverage) within a time period of 2 h before, through to 2 h after, drinking alcohol.

To investigate negative consequences of alcohol consumption, the Brief Young Adult Alcohol Consequences Questionnaire (BYAACQ: Kahler, Strong, & Read, 2005) was completed. The BYAACQ contains 24 possible consequences of alcohol consumption, with participants indicating whether the statement was applicable to them in the past year. In addition to the standard BYAACQ, following the Dutch student survey (de Haan, de Haan, Olivier, et al., 2012; de Haan, de Haan, van der Palen, et al., 2012; Verster et al. 2014) two additional items were included to determine whether participants were injured or got into a fight after alcohol consumption. A higher score in the range of 0–24 indicated higher engagement in negative alcohol-related consequences. Depending on the participant's specific drinking behaviour, the BYAACQ and additional items were completed for AO, AMED and AMOB.

Lastly, participants answered questions regarding the reasons/motivations for consuming energy drinks, as well as the reasons/motivations for mixing alcohol with energy drinks and other non-alcoholic beverages. Participants could report multiple reasons and add additional motives behind their beverage consumption patterns. To establish consistency with previous research (de Haan, de Haan, Olivier, et al., 2012; de Haan, de Haan, van der Palen, et al., 2012; Verster et al., 2014) and allow for direct cross-cultural comparisons, the standardised motive statements were categorised as neutral or negative according to their presumed effect on overall

Table 1
Consumption questions.

Alcohol only	Energy drinks only	Alcohol mixed with energy drinks	Alcohol mixed with other beverages
1. At what age did you first consume alcohol?	1. How many energy drinks do you usually have on one occasion?	1. When you combine, how many alcoholic drinks and energy drinks do you usually have on one occasion?	1. What non-alcoholic beverage do you most often combine with alcohol?
2. At what age did you consume alcohol regularly?	2. In the past 30 days, how many days did you drink energy drinks?	2. In the past 30 days, how many days did you combine energy drinks and alcohol?	2. When you combine, how many alcoholic drinks and glasses of [X] do you usually have on one occasion?
3. How many standard drinks do you usually have on one occasion?	3. In the past 30 days, how many times did you have 3 or more energy drinks on one occasion?	3. In the past 30 days, while combining, how many days did you get drunk?	3. In the past 30 days, how many days did you combine [X] and alcohol?
4. In the past 30 days, how many days did you drink alcohol?	4. In the past 30 days, what is the greatest number of energy drinks you had on one occasion?	4. While combining in the past 30 days, how many times did you have more than 5 (males)/4 (females) alcoholic drinks on one occasion?	4. In the past 30 days, while combining alcohol with [X], how many days did you get drunk?
5. In the past 30 days, how many days did you get drunk?	5. In the past 12 months, what was the greatest number of energy drinks you consumed on one occasion?	5. While combining in the past 30 days, what was the greatest number of alcoholic drinks you consumed on one occasion?	5. While combining in the past 30 days, how many times did you have more than 5 (males)/4 (females) alcoholic drinks on one occasion?
6. In the past 30 days, how many times did you have more than 5 (males)/4 (females) alcoholic drinks on one occasion?		6. On that occasion (previous question), how many hours did you consume alcohol?	6. While combining in the past 30 days, what was the greatest number of alcoholic drinks you consumed on one occasion?
7. In the past 30 days, what is the greatest number of alcoholic drinks you had on one occasion?		7. While combining in the past 30 days, what was the greatest number of energy drinks you consumed on one occasion?	7. On that occasion (previous question), how many hours did you consume alcohol?
8. On that occasion (previous question), how many hours did you consume alcohol?		8. While combining in the past 12 months, what was the greatest number of alcoholic drinks and energy drinks you consumed on one occasion?	8. While combining in the past 30 days, what was the greatest number of [X] you consumed on one occasion?
9. In the past 12 months, what was the greatest number of alcoholic drinks you consumed on one occasion?			9. While combining in the past 12 months, what was the greatest number of alcoholic drinks and [X] you consumed on one occasion?

Note: [X] applies to the mixer preferred by the participant.

alcohol consumption. Negative motives were those associated with increased alcohol consumption. All other motives were labelled as neutral, as no effect on the direction of total alcohol consumption could be predicted from previous research.

3.1. Data collection and statistical analysis

The online survey tool SurveyMonkey® (Palo Alto, CA) was used to collect participant responses between 7th April 2014 and 12th May 2014. Once the survey had closed the data was cleaned in Microsoft Excel and analysed using the Statistical Package for the Social Sciences version 20 (SPSS Inc, Chicago, IL). For the analysis in this paper, data were used for the energy drinks-only group (consumed energy drinks but never mixed energy drinks with alcohol) and AMED group (consumed energy drinks and also consumed AMED) using a within-subjects design (i.e., comparing – within the same subjects – alcohol consumption on occasions when only alcohol was consumed versus other occasions where alcohol was mixed with an energy drink or other non-alcohol beverages).

The mean, standard deviation and frequency distribution were computed for all variables. Variables with a normal distribution were tested with the analysis of variance. For nominal variables, a Chi Square test was used. The percentage of participants that indicated each motive for energy drink consumption was computed. The same data analysis was applied to motives for mixing alcohol with an energy drink or other non-alcoholic beverages. Following this, within the AMED group, participants were classified as having either neutral or negative reasons for mixing alcohol with energy drinks. Mixing for negative reasons was defined as participants confirming that they consumed AMED for at least one of the following reasons: “to get drunk”, “to prevent getting drunk”, “it feels like I can drink more alcohol”, “it feels like energy drinks reduce the negative effects of alcohol”, and “to sober up”. Although classified as the negative motives group, participants could choose as many motives as applied to them and therefore could also have endorsed neutral reasons for mixing. To determine whether alcohol consumption within the AMED-“negative motives” subgroup differed between occasions on which they consumed AO versus occasions when they consumed AMED, paired samples t-tests were used. Lastly to determine whether there were any differences in alcohol consumption between AMED, AMOB and AO occasions, a repeated-measures ANOVA was conducted. All comparisons were two-tailed and regarded as significant at $P < 0.05$.

4. Results

A total of 896 participants reported consuming energy drinks. Of these, 732 indicated that they mixed alcohol with energy drinks as well as consuming energy drinks by themselves, with the remaining ($N = 164$) stating that they had never mixed them with alcohol. All participants were alcohol consumers. The demographics of both groups can be found in Table 2.

4.1. Motives for consuming energy drinks

Fig. 1 summarises the motives for consuming energy drinks (without alcohol). The most frequency reported motives for consuming energy drinks included “to keep me awake” (61.9%), “I like the taste” (55.6%) and “it gives me energy” (47.1%).

4.2. Motives for mixing alcohol with energy drinks (AMED)

The motives for consuming alcohol mixed with energy drinks (AMED) were answered by 732 participants. As can be seen in Fig. 2, the most frequently reported neutral motives for consuming AMED were “I like the taste” (66.5%), followed by “to celebrate a special

Table 2
Between-group demographics of those who consume energy drinks only and those who consume AMED.

	Energy drinks only group (N = 164)	AMED group (N = 732)	Cohen's *d*	*P* value
Male/female ratio M%/F% (CI%)	39%/61% (±7.46%)	45.9%/54.1% (±3.61%)	0.11	0.109
Age (years), $\bar{x}$ (SD)	21.2 (2.4)	20.6 (2.0)	0.27	0.001*
Member of student union % (CI%)	66.3% (±7.26%)	59.6% (±3.56%)	0.13	0.152
Member of sports/society group % (CI%)	48.8% (±7.65%)	53.8% (±3.61%)	0.08	0.248
Medication use (past year) % (CI%)	17.7% (±5.84%)	19.5% (±2.87%)	0.04	0.586
Illicit drug use (past year) % (CI%)	17.7% (±5.84%)	24.9% (±3.13%)	0.13	0.050
Current smoker % (CI%)	14.0% (±5.31%)	25.8% (±3.17%)	0.22	0.001*

Notes: % = yes. 95% CIs. *Significant differences (P < 0.05) between the groups.
Abbreviations: AMED, alcohol mixed with energy drinks; N, number; $\bar{x}$, mean; SD, standard deviation; CI, confidence intervals.

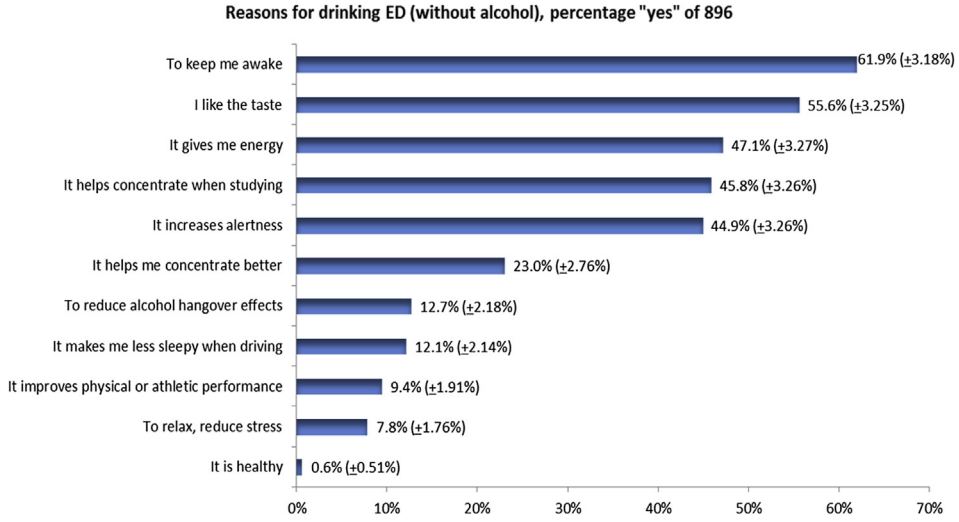

Fig. 1. Motives for energy drink consumption (without alcohol). Notes: % = yes (CI%). Abbreviations: ED, energy drinks; CI, confidence interval.

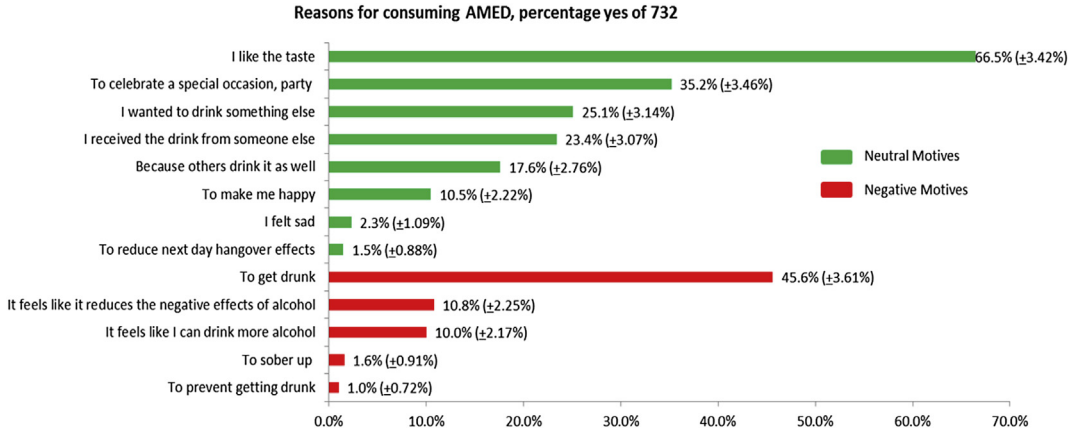

Fig. 2. Endorsement of neutral and negative motives for mixing alcohol with energy drinks (AMED). Notes: % = yes (CI%). Abbreviations: AMED, alcohol mixed with energy drinks.

occasion, party" (35.2%), "I wanted to drink something else" (25.1%) and "I received the drink from someone else" (23.4%). With regard to negative motives, "to get drunk" was reported by 45.6% of participants. All other negative motives were reported by a relatively small minority of participants.

4.3. Negative motives for mixing alcohol with energy drinks

52.6% of participants reported consuming AMED for at least one of the five negative motives illustrated in Fig. 2. When comparing these with the remaining AMED consumers who only reported neutral motives (47.4%), it was found that those who consume AMED for negative motives are significantly more often younger, male, smoke more tobacco, consume alcohol regularly at an earlier age and experience more negative alcohol-related consequences on both AO and AMED occasions (see Table 3.).

In order to determine whether the type of motive had a differential effect on overall alcohol consumption within-subjects comparisons on alcohol consumption questions and total BYAACQ score were conducted among those who consumed AMED for negative motives (N = 385) and those who consumed AMED for neutral motives (N = 347). As can be seen in Figs. 3 and 4, regardless of whether participants consumed AMED for negative or neutral motives on the occasions they drank AMED they consumed

Table 3
Comparison of subjects who consume AMED for negative and neutral motives.

	Mixing for negative motives (N = 385)	Mixing for neutral motives (N = 347)	Cohen's *d*	*P* value
Male/female ratio M%/F% (CI%)	50.6%/49.4% (±4.99%)	40.6%/59.4% (±5.17%)	0.20	0.007*
Age (years), $\bar{x}$(SD)	20.4 (1.9)	20.8 (2.1)	−0.20	0.004*
Member of student union % (CI%)	57.9% (±4.93%)	61.4% (±5.14%)	0.09	0.486
Member of sports/society group % (CI%)	51.7% (±4.99%)	56.1% (±5.23%)	0.09	0.236
Medication use (past year) % (CI%)	19.2% (±3.93%)	19.9% (±4.2%)	0.02	0.821
Illicit drug use (past year) % (CI%)	27.5% (±4.46%)	21.9% (±4.35%)	0.13	0.078
Current smoker % (CI%)	30.4% (±4.59%)	20.7% (±4.26%)	0.22	0.003*
Age first consumed alcohol $\bar{x}$(SD)	13.7 (3.0)	14.1 (2.8)	−0.14	0.097
Age consumed alcohol regularly $\bar{x}$ (SD)	16.9 (1.7)	17.2 (1.5)	−0.19	0.006*
BYAACQ score alcohol only $\bar{x}$ (SD)	10.35 (5.5)	7.05 (4.7)	0.65	<0.001*
BYAACQ score AMED $\bar{x}$ (SD)	8.4 (5.1)	5.2 (4.4)	0.67	<0.001*

Notes: % = yes. 95% CI. *Significant differences (P < 0.05) between negative and neutral motives.
Abbreviations: N, number; $\bar{x}$, mean; SD, standard deviation; CI, confidence interval; AMED, alcohol mixed with energy drinks; BYAACQ, brief young adult alcohol consequences questionnaire.

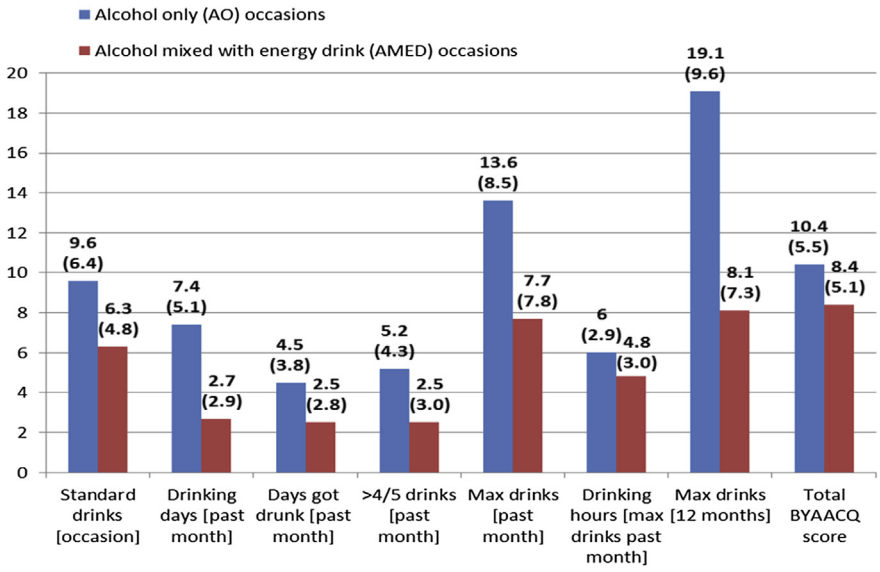

Fig. 3. Within-subjects comparisons of drinking behaviour of participants who consumed AMED for negative reasons. Notes: Occasions when they consumed AMED are compared with the occasions when they only consumed alcohol. $\bar{x}$ (SD). All two-tailed comparison were significant different (P < 0.001). N = 385. Abbreviations: BYAACQ, brief young adult alcohol consequences questionnaire; $\bar{x}$, mean; SD, standard deviation.

significantly less alcohol and experienced fewer negative alcohol-related consequences compared to those occasions on which they consumed AO. However, those who endorsed negative motives were more likely to consume more alcohol and engage in more negative alcohol-related consequences on AO and AMED occasions compared to those who endorsed neutral motives.

4.4. Comparison with other mixers

In order to assess whether there were any differences in the motives and alcohol consumption patterns between occasions on which participants mixed alcohol with energy drinks and other occasions on which they consumed alcohol mixed with other non-alcoholic beverages, within-subjects comparisons were conducted on those who consumed both AMED and AMOB (N = 550).

As can be seen in Table 4, the motives for consuming alcohol with other mixers were in-line with those reported for consuming AMED. However, there were some statistically significant differences in the motives reported for consuming AMED and AMOB. With regard to neutral motives, more participants reported consuming AMED to "celebrate a special occasion", because "others drink it as well", they "got the drink from someone else" or because they "felt sad" when compared to consuming AMOB. However, more participants reported consuming AMOB because they "like the taste" compared to AMED. For negative motives, more participants reported consuming AMED "to get drunk" and "to reduce the negative effects of alcohol" compared to consuming AMOB. Conversely, more participants reported that "it feels I can drink more alcohol" for AMOB when compared to AMED.

A repeated-measures ANOVA with a Huynh-Feldt correction determined that all alcohol consumption questions differed statistically significantly between AO, AMED and AMOB consumption occasions (Table 5). Post hoc tests using the Bonferroni correction revealed that each pairwise difference was significant, P < 0.001. On the occasions participants drank AMED they consumed significantly less alcohol and were drunk less often compared to those occasions when they consumed AMOB. In addition, the frequency and quantity of alcohol consumed on both AMED and AMOB occasions were significantly less than occasions on which participants consumed AO.

5. Discussion

The results of this study indicate that the primary motives for consuming energy drinks relate to the expected positive effects of the drinks functional ingredients, including to keep me awake and

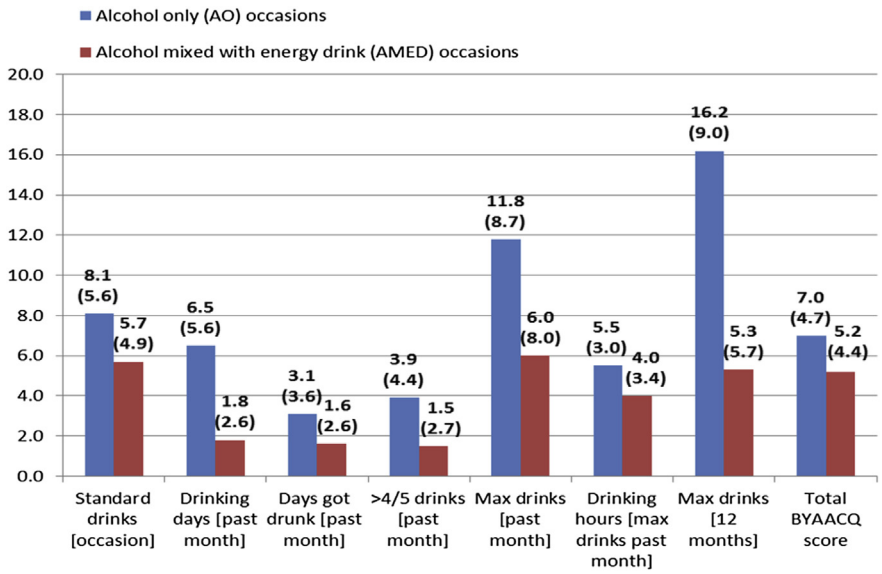

Fig. 4. Within-subjects comparisons of drinking behaviour of participants who consumed AMED for neutral reasons. Notes: Occasions when they consumed AMED are compared with the occasions when they only consumed alcohol. $\bar{x}$ (SD). All two-tailed comparison were significant different ($P < 0.001$). $N = 347$. Abbreviations: BYAACQ, brief young adult alcohol consequences questionnaire; $\bar{x}$, mean; SD, standard deviation.

Table 4
Endorsement of neutral and negative motives for mixing alcohol with energy drinks or other non-alcoholic beverages (N = 550).

	Energy drinks	Other beverages	Cohen's *d*	*P* value
Neutral motives for mixing with				
I like the taste % (CI%)	73.5% (±3.69%)	89.5% (±2.56%)	0.60	<0.001*
I wanted to drink something else % (CI%)	27.6% (±3.74%)	23.8% (±3.56%)	0.14	0.101
To celebrate a special occasion, party % (CI%)	40.5% (±4.1%)	29.6% (±3.82%)	0.41	<0.001*
Received the drink from someone (and did not want to refuse it) % (CI%)	26.5% (±3.69%)	11.1% (±2.63%)	0.70	<0.001*
To make me happy % (CI%)	11.3% (±2.65%)	12.2% (±2.74%)	0.04	0.649
Because others drink it as well % (CI%)	20.4% (±3.37%)	16.0% (±3.06%)	0.19	0.024*
To reduce next day hangover effects % (CI%)	1.3% (±0.95%)	1.6% (±1.05%)	0.29	0.774
I felt sad % (CI%)	2.7% (±1.35%)	0.7% (±0.7%)	0.22	0.007*
Negative motives for mixing with				
To get drunk % (CI%)	53.1% (±4.17%)	34.2% (±3.96%)	0.72	<0.001*
It feels like it reduces the negative effects of alcohol % (CI%)	11.1% (±2.62%)	6.0% (±1.98%)	0.29	0.001*
It feels like I can drink more alcohol % (CI%)	10.9% (±2.6%)	18.9% (±3.27%)	0.36	<0.001*
To prevent getting drunk % (CI%)	0.9% (±0.79%)	1.6% (±1.05%)	0.07	0.424
To sober up % (CI%)	2.0% (±1.17%)	1.5% (±1.02%)	0.05	0.581

Notes: % = yes. 95% CI. *Significant differences ($P < 0.05$).
Abbreviations: N, number; CI, confidence interval.

Table 5
Within-subjects comparisons of alcohol consumption on alcohol only, AMED and AMOB occasions.

Alcohol consumption among those who consume AMED and AMOB (N = 550).	Alcohol-only occasion ($\bar{x}$, SD)	AMED occasion ($\bar{x}$, SD)	AMOB occasion ($\bar{x}$, SD)	Cohen's *f*	*P* value
How many standard drinks do you usually have on one occasion?	9.0 (6.1)	6.1 (5.0)	6.7 (5.0)	0.40	<0.001
In the past 30 days, how many days did you drink alcohol?	7.2 (5.2)	2.3 (2.8)	4.1 (3.8)	0.82	<0.001
In the past 30 days, how many days did you get drunk?	3.9 (3.6)	2.1 (2.7)	3.0 (3.3)	0.53	<0.001
In the past 30 days, how many times did you have more than five (male)/four (female) alcohol drinks on one occasion?	4.7 (4.2)	2.0 (2.9)	3.0 (3.2)	0.59	<0.001
In the past 30 days, what is the greatest number of alcoholic drinks you had on one occasion?	13.0 (8.4)	7.1 (8.0)	8.3 (7.6)	0.65	<0.001
On that occasion (previous question), how many hours did you consume alcohol?	5.8 (2.8)	4.5 (3.1)	5.0 (3.0)	0.39	<0.001
In the past 12 months, what was the greatest number of alcoholic drinks you consumed on one occasion?	18.0 (9.4)	6.9 (6.8)	9.3 (7.1)	1.00	<0.001

Abbreviations: AMED, alcohol mixed with energy drinks; AMOB, alcohol mixed with other non-alcoholic beverage; N, number; $\bar{x}$, mean; SD, standard deviation.

to give me energy, as well as consumers appreciation of the energy drink taste.

The motives for mixing alcohol with energy drinks and other non-alcoholic beverages were similar in their distribution across motive statements. For example, the most frequently reported neutral motives on both AMED and AMOB occasions were "I like the taste", "to celebrate a special occasion", "I wanted to drink something else", "I got the drink from someone else" and "because others

drink it". However, significantly more students reported consuming AMED "to celebrate a special occasion", "because others drink it as well" and because "I got the drink from someone else" compared to when consuming AMOB. Similar to previous research (Jones & Barrie, 2009) these findings suggest that students often drink mixers (energy drinks or other non-alcoholic beverages) with alcohol as a group bonding experience to make special nights out, such as birthdays more enjoyable. But that energy drinks are more frequently the chosen mixer for these motives in comparison to other non-alcoholic beverages. Drinking AMED and AMOB "to celebrate a special occasion" can be deduced by the significantly lower number of reported occasions consuming them (2.3 and 4.1, respectively) in the past 30 days, compared to the frequency of consuming alcohol alone (7.2).

In regard to negative motives, of concern were the high number of students who reported consuming both AMED and AMOB "to get drunk". This may be explained by the fact that Britain is one of the worst countries in the world for binge drinking (World Health Organization, 2014) and that drinking alcohol to get drunk is a well-established characteristic of student life. However, despite a high number of students reporting drinking "to get drunk" in both drinking occasions, drinking AMED "to get drunk" was reported significantly more often than drinking AMOB "to get drunk". On the other hand significantly more students reported consuming AMOB than AMED "because it feels they can drink more alcohol". The latter is supported by the within-subjects finding that alcohol consumption was significantly lower on occasions when students consumed AMED compared with occasions when they consumed AMOB. Therefore although more students reported consuming AMED than AMOB "to get drunk", more students reported consuming AMOB to increase the quantity of alcohol they consume than when consuming AMED and this was reflected in overall alcohol consumption levels.

In addition, alcohol consumption was also significantly lower on occasions when students consumed AMED compared with the occasions when they consumed AO. Even when looking at the 52.6% who consumed AMED for one or more of the negative motives, including "to get drunk" and "because it feels I can drink more alcohol", alcohol consumption was still significantly lower on AMED occasions compared to occasions when they consumed AO. These findings are in contrast to previous claims that mixing alcohol with energy drinks might increase overall alcohol consumption (Berger et al., 2011; Snipes & Benotsch, 2013; Thombs et al., 2010), and that the type of motive has a differential effect on alcohol consumption or risk of negative outcomes (Droste et al., 2014). Interestingly, alcohol consumption levels were also significantly lower on AMOB occasions compared to AO occasions, suggesting that although students may consume AMOB to increase the quantity of alcohol consumed this is not reflected in actual consumption levels when compared to AO consumption occasions.

One further finding was that more students reported consuming AMED than AMOB "to reduce the negative effects of alcohol". A possible explanation is that the expected positive effects of energy drinks functional ingredients, including staying awake and having more energy, may underlie the motive to consume AMED to reduce the negative effects of alcohol when enjoying a special occasion. However, only an additional 5% of students reported consuming AMED "to reduce the negative effects of alcohol", therefore although significantly different this may not be of real life relevance. No other significant differences in the negative motives for consuming AMED and AMOB were found.

5.1. Strengths

This is the first UK survey with a relatively large sample size that has provided useful insights into AMED consumption patterns and motivations for use among students from across the UK.

One advantage of the present study over previous research is that it utilised a within-subjects design. This allowed comparisons of the frequency and quantity of alcohol consumed by the same individuals on occasions when they consumed alcohol alone, occasions they mixed alcohol with energy drinks, and occasions they mixed alcohol with other non-alcoholic beverages. This is an advantage over the between-group design employed by previous research, as it controls for the many demographic and personality variables that may differ between those who consume AMED and those who consume AO, allowing us to determine whether the observed differences were related to the co-consumption of energy drinks or not. Within-subjects comparisons were also made for motives on AMED occasions and AMOB occasions.

5.2. Limitations

The current survey collected absolute alcohol consumption values and incidence of negative alcohol-related consequences across all consumption occasions. This method was chosen as it provides a clear real-world comparison of consumption levels and incident for each drinking occasion. Some researchers (Rossheim, Suzuki, & Thombs, 2013) have argued that this approach fails to take into account the relative frequency of AMED and AMOB consumption versus AO consumption. Indeed, within the current survey participants reported using AMED (2.3) and AMOB (4.1) less often in the past 30 days than AO (7.2). However, research by Peacock et al. (2015) that controlled for the frequency of use failed to support the hypothesis that the differences in alcohol consumption and negative alcohol-related consequences can be explained by the relative infrequency of AMED drinking occasions compared to AO occasions. Further analysis of the current dataset, controlling for the frequency of use, may contribute to this debate.

In addition the survey did not collect data on the motives for consuming alcohol alone. This may be of importance as a baseline measure in trying to understand why students decide to consume alcohol-only on some occasions but combine with energy drinks or other non-alcoholic beverages on other occasions. Caution must also be taken when inferring relationships between consumption motives and the amount of alcohol consumed. This is because participants in this survey were asked whether each motive applied to consuming AMED or AMOB. No information was obtained on what occasions or how important each motive was, and how this was linked to the amount of alcohol consumed on those occasions. Future research, possibly utilising a qualitative methodology, is needed to further explore the importance given to the motives underlying alcohol consumption patterns on specific occasions, such as during a celebratory party versus a regular visit to the pub.

As with all previous research on the motives for consuming AMED, the present survey relied on students to retrospectively recall the number and type of drinks consumed, either in the past 30 days or 12 months. The ability to reliably recall this information is likely to have been affected by the high volume of alcohol reportedly consumed. However, given the within-subjects design employed there is no reason to assume the ability to recall such information differed on AMED, AMOB and AO occasions. Prospective diary studies, possibly using smartphone technology to collect alcohol and energy drink consumption data, may be useful in addressing participants ability to recall information shortly after the drinking occasion.

When considering the differences found in alcohol consumption and motivations for use between AMED and AMOB occasions, it must be considered that within the AMOB occasions students could report that they consume caffeinated (cola) or non-caffeinated

(orange juice) beverages with alcohol. Therefore no conclusions should be drawn on the role caffeine is playing in effecting alcohol consumption or motivations for use between AMED and AMOB occasions in this survey. Further statistical analysis of the current dataset is required to explore this.

Furthermore, although the decision to categorise each motive as neutral or negative was based on previous research, caution must be taken when discussing these findings as it may not be so easy to determine how negative one motive is, in terms of its effects on overall alcohol consumption, compared to another. For example, I like the taste was reported by the majority of students as a reason for consuming AMED and AMOB. Although it can be reasonably assumed that this is a neutral motive, it could also be argued that enjoying the taste could actually put one at risk of consuming further quantities of alcohol. On the other hand, both 'to reduce next day hangover effects' and 'to sober up' are categorised as negative motives but could be deemed as 'positive' and 'functional' motives. In addition, the list of possible motives in the survey were not exhaustive, therefore there may be other motives that could be important in determining the reasons for consuming AMED and AMOB. However, despite the survey providing the opportunity for participants to report any additional motives outside of the standard motive statements in an open ended question, no motives of significant interest were reported.

Lastly, the current sample focused on university students and therefore results cannot be generalised beyond the student population. Given the unique drinking practices among students, it is likely that differences will be observed in the general population.

In summary, these results are similar to previous research on the motives for mixing alcohol with energy drinks (Brache et al., 2012; Marczinski, 2011; O'Brien et al., 2008; Peacock et al., 2013; Verster et al., 2014) in that the majority of reported motives were neutral in nature. However, some important differences have been highlighted. In comparing our findings with the only other study (Verster et al., 2014) to examine motives for AMED consumption and make direct comparisons between the motives for consuming AMED and AMOB, two substantial differences were observed. Firstly, a significantly higher percentage (52.6% compared to 21.6%) of AMED consumers reported consuming AMED for at least one of the five negative motives, with a vast majority of these reporting consuming AMED "to get drunk". However, similar to Verster et al. (2014) the type of motive (negative or neutral) had no differential effect on overall alcohol consumption. Secondly, significant differences in the motives for consuming AMED and AMOB were identified, suggesting that UK students may be unique in their consumption of AMED as a group bonding experience on special occasions, such as parties. To investigate this further, cross-cultural differences will be examined between the United Kingdom, The Netherlands and Australia. In addition further research is required to examine the social and situational factors that may moderate UK student motives for AMED consumption.

6. Conclusion

In-line with previous research, this first-known UK student survey, found that the primary reasons for mixing alcohol with energy drinks and other non-alcoholic beverages relate to neutral motives, and that the type of motive (neutral or negative) had no differential effect on total alcohol consumption. A high percentage of students reported consuming both AMED and AMOB to get drunk. This was reflected in the fact that, independent of motives or drinking occasion, students consumed alcohol at substantially higher levels than those recommended as safe in the UK. Interesting differences in the drinking motives and overall alcohol consumption were observed between the occasions when energy drinks or non-alcohol beverages were mixed with alcohol. These suggest that AMED is the preferred mixer during special occasions and used as a group-bonding experience, but that alcohol consumption is significantly lower on such occasion in comparison to occasions when AMOB or AO are consumed.

Authors' contributions

SJ led the study presented in this paper; collected, analysed, interpreted the data and drafted the manuscript. CA, JV and KS participated in the design and coordination of the study and helped to draft and review the manuscript. Each author has participated sufficiently in the work to take public responsibility for appropriate portions of the content. All authors read and approved the final manuscript.

Competing interests

Sean J Johnson has undertaken sponsored research for a number of companies including Pfizer, AstraZeneca, Merck, Gilead, Novartis, Roche and Red Bull GmbH.

Chris Alford has undertaken sponsored research, or provided consultancy, for a number of companies and organisations including Astra, British Aerospace/BAeSystems, Civil Aviation Authority, Duphar, FarmItalia Carlo Erba, Ford Motor Company, ICI, Janssen, LERS Synthélabo, Lilly, Lorex/Searle, Ministry of Defense, Quest International, Red Bull GmbH, Rhone-Poulenc Rorer, Sanofi-Aventis.

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Karina Stewart has no competing interests.

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