



Youth consumption of alcohol mixed with energy drinks in Canada: Assessing the role of energy drinks

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ABSTRACT

Consuming alcohol mixed with energy drinks (AmED) is a risk behaviour among youth, and previous research has reported a positive association between binge drinking and AmED consumption. However, limited research has examined how regular consumption of energy drinks is associated with AmED consumption among youth. The purpose of this report is to examine the role of energy drink use on AmED consumption in a Canadian youth population. Using data from the 2015–2016 COMPASS survey including 35,300 grade 9 to 12 students, two logistic regression models investigated if the inclusion of energy drink consumption in the past week altered the results of a model examining AmED consumption. In this sample, 13.2% of students reported AmED consumption in the last 12 months. Those who reported drinking energy drinks in the past week were 3.38 times more likely to consume AmED than those who did not drink energy drinks. The inclusion of past week energy drink use decreased the effect size of other associated substance use behaviours. This report demonstrates that past week energy drink use is associated with increased likelihood of AmED consumption and suggests that previous research may have missed this important contributor. These findings along with existing energy drink research highlight the importance of addressing the lack of energy drink regulations in Canada.

1. Introduction

The consumption of energy drinks has increased in recent years, particularly among youth populations (Heckman et al., 2010). Recent data indicates that over 15% of Canadian youth report weekly energy drink use (Reid et al., 2015). Energy drinks are typically composed of caffeine, glucose, and often other ingredients such as taurine, guarana, and B-vitamins (Heckman et al., 2010). By and large, energy drinks are nutritionally void, and often contain excessive amounts of sugar and caffeine (Heckman et al., 2010). Energy drink consumption has been linked to a variety of negative cardiovascular and neurological effects, and consumption is of particular health concern for youth (Ali et al., 2015). Although Health Canada prohibits the marketing of energy drinks to youth, research indicates that North American energy drink manufacturers continue to do so (Heckman et al., 2010; Markey et al., 2013).

A common practice among adolescents is to mix alcohol with energy drinks (AmED); research has previously suggested that up to one in five Canadian youth consume AmED (Azagba et al., 2013). Given the health risks associated with energy drinks as well as the hazards of alcohol use in adolescents (Squeglia et al., 2014; Buchmann et al., 2009), youth

AmED consumption is strongly discouraged. Health Canada prohibits the sale of pre-mixed alcoholic drinks containing energy drinks, and requires that energy drinks include a label stating, “do not mix with alcohol” (Health Canada, 2015). However, youth are largely unaware of these caution labels due to their small font and hidden placement (Reid et al., 2017), and perceive that there is little risk that accompanies consuming AmED (McCrory et al., 2017).

Much of the AmED literature focuses on associations with binge drinking, (Azagba et al., 2013; Martz et al., 2015; Khan et al., 2016), and most studies do not examine whether regular energy drink use may impact propensity to consume AmED. However, energy drink consumption alone has been positively associated with substance use behaviours (Emond et al., 2014; Polak et al., 2016; Trapp et al., 2014). One study that assessed the role of energy drinks found positive associations between energy drink use and AmED consumption in a young adult population (Velazquez et al., 2012), but this type of association has yet to be examined in youth. Hence, this brief report aims to examine the association between energy drinks and AmED consumption in a youth context in Canada. This research will update the results of a previous Canadian study examining AmED use in youth (Azagba et al., 2013), but will also fill a research gap by exploring the role of energy

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drink use. Research in this sample is timely given the recent Ontario legislation that permits alcohol to be sold in grocery stores (Government of Ontario, 2015), as alcohol and energy drinks can now be sold in the same location. While this new legislation only permits the sale of beer and wine (which would not typically be mixed with energy drinks), it appears that the likely next step for legislation would be to allow the sale of distilled alcohol (or “hard liquor”), and there is concern that AmED will become increasingly easy to consume.

2. Methods

2.1. Design

This cross-sectional analysis uses the data from Year 4 (2015–2016) of the COMPASS host study, collected from 40,436 (79.9% response rate) grade 9 to 12 students in Ontario and Alberta, Canada. The COMPASS study is a prospective cohort study that collects data from grade 9 to 12 students using active information passive consent permission protocols, which is important for examining youth behaviours related to substance use (Rojas et al., 2008). A full description of the COMPASS study methods can be found in print (Leatherdale et al., 2014) or online (www.compass.uwaterloo.ca). This research used complete case analysis, and as such a total of 35,300 students were included in the final sample.

2.2. Dependant variable

Students were asked to report, “In the last 12 months, have you had alcohol mixed or pre-mixed with an energy drink (such as Red Bull, Rock Star, Monster or another brand)?”; a binary outcome was derived from students' responses.

2.3. Independent variables

The responses from two questions were combined to assess energy drink consumption. The first question asks, “In a usual school week (Monday to Friday), on how many days do you do the following?” where the option of interest is “Drink high-energy drinks (Red Bull, Monster, Rock Star, etc.)” and the options range from “None” to “5 days.” The second question asks, about usual weekend (Saturday and Sunday) use of high-energy drinks (options range from “None” to “2 days”). Anyone who reported consuming energy drinks once or more in a usual week (Monday to Sunday) was classified as an energy drink user.

As substance use behaviours tend to cluster in youth (Richter et al., 2017; Leatherdale, 2015), smoking status (smoker, non-smoker), marijuana use status (yes, no), and binge drinking status (never, light, heavy) are included as predictors. Participants were classified as a smoker if they reported smoking a cigarette in the past 30 days. Marijuana use status is classified such that those who reported using marijuana at least once a month in past 12 months are recorded as ‘yes’. Consistent with previous research (Herciu et al., 2014) individuals who have never engaged in binge drinking (i.e., consuming 5 or more drinks on one occasion) were classified as ‘never binge drinkers’, those that engaged in binge drinking less than once a month were classified as ‘light binge drinkers’, and those that engaged in binge drinking once a month or greater were classified as ‘heavy binge drinkers’. Given established connections between sports participation and substance use behaviours (Veliz et al., 2015; Moore and Werch, 2005), participation in school team sports (yes, no) was also included as a predictor variable. School achievement and connectedness variables serve as important factors that predict substance use in youth (Li and Lerner, 2011), therefore math grade (< 70%, ≥ 70%), classes skipped in the past 4 weeks (None, 1–2 days, ≥ 3 days), and school connectedness are included as predictors. Consistent with previous research, a continuous variable representing school connectedness was calculated based on the

level of agreement with 6 different questions (Weatherson et al., 2018). Control variables in the present analysis included: gender (male, female), grade level (Reid et al., 2017; McCrory et al., 2017; Martz et al., 2015; Khan et al., 2016), Province (ON, AB), ethnicity (White, Asian, Black, Aboriginal (First Nations, Metis, Inuit), Latin American/Hispanic, or Other), and spending money (≤ \$40, > \$40, unknown).

2.4. Analysis

Statistical analyses were performed using SAS 9.4 (SAS Institute Inc., Cary, NC, USA). Logistic regression models explored the association between AmED use and predictors, adjusting for covariates. Closely replicating the methods from a previous study by Azagba et al. (2013), Model 1 includes known predictors of AmED. Replicating the main model from this previous Canadian study will allow for comparison to earlier findings in a similar population. Model 2 includes all variables present in Model 1, but adds the energy drink consumption variable. This stepwise approach will allow comparison between models to discern how inclusion of energy drink use impacts findings. The SAS procedure PROC GENMOD was used for regression analyses, specifying exchangeable working correlation to account for school clustering.

3. Results

The prevalence of youth who reported consuming AmED within the last 12 months was 13.2%. Table 1 compares demographic characteristics of AmED users and non-users in this sample. Energy drink consumption was significantly higher among AmED users (44.5%) than non-users (10.9%) ($\chi^2 = 3688.3$, $df = 1$, $p < .0001$). Table 2 presents the results of the two logistic regression models. Results from Model 1 demonstrate that substance use behaviours predict AmED consumption, with the strongest predictor being heavy binge drinking (OR 2.29, 95% CI 2.06–2.55). In Model 2, results are generally consistent with Model 1, however past week energy drink use is demonstrated to be the strongest predictor of AmED consumption (OR 3.38, 95% CI 3.05–3.75), and the effect of other substance use behaviours decrease in magnitude.

4. Discussion

Consistent with previous research (Azagba et al., 2013; Khan et al., 2016; Emond et al., 2014) we identified that roughly 1 in 10 youth in our large sample reported AmED use. Findings from the present study aligned with the aforementioned study of AmED in a Canadian youth population (Azagba et al., 2013) showing positive associations between substance use behaviours such as binge drinking and AmED consumption. However, our findings indicate that energy drink use plays an important role in predicting AmED consumption in youth; those who reported past week energy drink use were 3.38 times more likely to consume AmED than those who reported no energy drink use, and this represented the strongest predictor of AmED consumption. This positive association between energy drink use and consumption of AmED aligns with an existing study of this type of association in adults (Velazquez et al., 2012). After including typical energy drink use within Model 2, the effects of all other included substance use behaviours (smoking status, binge drinking, marijuana use) decreased. These findings indicate that previous studies which neglected to include a measure of typical energy drink use may have overestimated the effects of other substance use behaviours on AmED consumption. However, it is still important to recognize other substance use behaviours as significant predictors of AmED consumption; after inclusion of energy drink use all three substance use behaviours remained significant, although showed smaller effect sizes.

Energy drink use has been associated with a variety of risk behaviours in youth, including alcohol use, smoking, and illicit drug use (Terry-McElrath et al., 2014); our report adds AmED to this list. In

Table 1
Demographic characteristics of past year AmED users and non-users, 2015–16 COMPASS study.

Covariates	AMED			Chi squared
	Total N = 38,066	No N = 33,037	Yes N = 5029	
		%	%	
Gender				111.3, df = 1, p < .0001
Female	48.9	50.0	41.9	
Male	51.1	50.0	58.1	
Grade				762.9, df = 3, p < .0001
Grade 9	26.5	28.3	14.9	
Grade 10	26.4	27.0	22.0	
Grade 11	25.4	24.8	29.0	
Grade 12	21.8	19.9	34.1	
Ethnicity				207.7, df = 4, p < .0001
White	68.8	69.9	61.6	
Black	4.2	3.9	6.1	
Asian	5.5	5.7	4.7	
Aboriginal (First Nations, Métis, Inuit)	2.7	2.5	4.0	
Other	18.8	18.0	23.5	
Province				32.46, df = 1, p < .0001
AB	8.2	10.2	7.9	
ON	91.8	89.8	92.1	
Spending money				741.1, df = 2, p < .0001
≤ \$40 spending money	55.7	57.9	41.4	
> \$40 spending money	32.3	29.7	49.1	
Unknown	12.0	12.3	9.5	
Smoking status				3906.6, df = 1, p < .0001
Nonsmoker	93.9	96.9	74.2	
Smoker	6.1	3.1	25.8	
Marijuana use (in past 12 months)				5860.3, df = 1, p < .0001
No	75.6	82.2	32.2	
Yes	24.4	17.8	67.8	
Binge drinking				7490.9, df = 2, p < .0001
Never binge drinkers	63.3	70.5	15.6	
Light binge drinkers	15.7	15.2	18.9	
Heavy binge drinkers	21.0	14.3	65.4	
Grade average (Math)				308.5, df = 1, p < .0001
< 70%	26.7	25.1	37.0	
≥ 70%	73.3	74.9	63.0	
School connectedness score (mean)	18.22	18.46	17.0	28.86, p < .0001
Classes skipped (in the past 4 weeks)				3311.1, df = 2, p < .0001
None	71.7	76.2	41.9	
1–2 days	17.7	16.4	26.5	
≥ 3 days	10.6	7.4	31.6	
Team sports participation				22.3, df = 1, p < .0001
No	58.0	58.4	54.9	
Yes	42.1	41.6	45.1	
Energy drink consumption in the past week				3688.3, df = 1, p < .0001
No	84.7	89.1	55.5	
Yes	15.3	10.9	44.5	

consideration of these findings, coupled with the potential negative health outcomes of energy drink consumption, upstream approaches to limit energy drink use and associated behaviours should be considered. In Canada, energy drinks are widely available, and upstream regulatory approaches that better control marketing and energy drink labelling could be considered.

The strengths of the present report include the large sample size and the inclusion of multiple known risk factors for AmED. Moreover, to our knowledge, this is the first study to identify the role of energy drink use on AmED consumption in a Canadian youth context. However, there are important limitations to note in this study. First, the present analysis is cross-sectional, and therefore no temporal associations can be made. Second, the data used in this study are self-report data, which can be subject to response bias. Third, this research treated the reported measures of past week energy drink use and AmED consumption as independent, in that our assumption is that when students reported their typical energy drink use, they were not referring to times that they mixed energy drinks with alcohol. If students included such occasions in their report of energy drink use, there is potential for overestimation

of the effects of energy drinks. However, given the phrasing of each question and the different time periods that they each address, this scenario is unlikely. Lastly, this sample only includes data from Ontario and Alberta, and therefore cannot be used to make associations about individuals in other jurisdictions.

5. Conclusion

Our findings demonstrate that energy drink use is a significant predictor of AmED consumption in youth. Future research should recognize the importance of including regular energy drink use in analyses that wish to examine correlates of AmED consumption. Upstream approaches such as stricter enforcement of marketing regulations around energy drinks and improved labelling should be considered.

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Table 2
Adjusted odds ratio estimates for the association between student characteristics and past year AmED use, 2015–16 COMPASS study.

Covariates	OR (95% CI) ^a (N = 35,300)	
	Model 1	Model 2
Gender		
Female	1	1
Male	1.27 (1.17–1.38)	1.05 (0.97–1.15)
Grade		
Grade 9	1	1
Grade 10	0.90 (0.80–1.00)	0.98 (0.88–1.09)
Grade 11	0.83 (0.72–0.95)	0.95 (0.83–1.09)
Grade 12	0.94 (0.81–1.08)	1.12 (0.98–1.28)
Ethnicity		
White	1	1
Asian	1.03 (0.85–1.25)	1.45 (1.21–1.73)
Black	1.53 (1.28–1.82)	1.50 (1.17–1.93)
Aboriginal (First Nations, Métis, Inuit)	1.62 (1.28–2.06)	0.99 (0.83–1.18)
Other	1.27 (1.17–1.38)	1.26 (1.17–1.37)
Province		
AB	1	1
ON	0.96 (0.84–1.11)	1.10 (0.96–1.26)
Spending money (per week)		
≤ \$40 spending money	1	1
> \$40 spending money	1.17 (1.07–1.29)	1.14 (1.04–1.26)
Unknown	0.98 (0.87–1.12)	1.00 (0.88–1.13)
Smoking status		
Nonsmoker	1	1
Smoker	2.12 (1.88–2.38)	1.70 (1.51–1.92)
Marijuana use (in past 12 months)		
No	1	1
Yes	2.48 (2.28–2.69)	2.33 (2.14–2.54)
Binge drinking status ²		
Never binge drinkers	0.27 (0.24–0.31)	0.28 (0.25–0.31)
Light binge drinkers	1	1
Heavy binge drinkers	2.29 (2.06–2.55)	2.19 (1.97–2.43)
Grade average (Math)		
< 70%	1	1
≥ 70%	0.88 (0.81–0.96)	0.92 (0.84–1.01)
School connectedness score	0.96 (0.95–0.97)	0.97 (0.96–0.98)
Classes skipped (in the past 4 weeks)		
None	1	1
1–2 days	1.30 (1.19–1.41)	1.24 (1.14–1.36)
≥ 3 days	1.84 (1.66–2.04)	1.69 (1.52–1.87)
Team sports participation		
No	1	1
Yes	1.13 (1.03–1.23)	1.17 (1.07–1.28)
Energy drink consumption in the past week		
No		1
Yes		3.38 (3.05–3.75)

^a Both logistic regression models were adjusted to account for school clustering.

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