



Individual, Social, and Environmental Correlates of Energy Drink Use Among Adolescents

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ABSTRACT

Objective: To investigate the correlates of adolescent energy drink (ED) use using a socioecological approach to inform future interventions.

Methods: In 2017–2018, 3,688 students attending 25 randomly selected Western Australian secondary schools completed a self-report survey. A backward stepwise logistic regression analysis was used to construct a model of the most significant individual (n = 12), social (n = 3), and environmental (n = 4) factors associated with being an ED user (ie, past month ED use).

Results: Overall, 18% of participants were ED users. The factors significantly associated with being an ED user included being male ($P < 0.001$), having a higher disposable income ($P < 0.001$), perceiving EDs as good for health ($P = 0.009$), perceiving EDs as safe for someone their age to drink ($P < 0.001$), having a sensation-seeking personality ($P = 0.011$), having friends who drink EDs ($P < 0.001$), having parents who would give them an ED if asked ($P < 0.001$), and having EDs available at home ($P < 0.001$).

Conclusions and Implications: Initiatives to reduce ED intake among adolescents need to be multifaceted, addressing individual, social, and environmental factors. It is also important that educational interventions target both parents and adolescents.

Key Words: energy drinks, adolescents, parents, ecological model, caffeine (*J Nutr Educ Behav.* 2022;54:255–262.)

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INTRODUCTION

Energy drinks (EDs) are highly caffeinated beverages marketed to boost

energy levels and mental performance. They have become an increasingly popular beverage choice, with the global ED market estimated

to reach \$72 billion by 2024.¹ In Australia, ED labels must state they are not recommended for children; however, no restrictions are placed on who can purchase these drinks, and they are widely available and accessible to children. There is a growing concern about increased ED consumption among young people, with ED use linked to negative physical health effects such as headaches, stomachaches, insomnia, fatigue, irritation, and hyperactivity/inattention symptoms and also associated with problematic behaviors, including higher rates of smoking, alcohol consumption (including binge-drinking) and other substance use, self-destructive behavior, problems with behavioral regulation and metacognitive skills, and increased sedentary behavior.^{2–4} Amid public health concerns, several countries (such as Denmark, Sweden, Turkey, Norway, Iceland, United Arab Emirates, Uruguay, Latvia, and Lithuania) have banned the sale of EDs to children or

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altogether. The UK government is considering placing a ban on the sale of EDs to children, having recently completed a parliamentary inquiry into ED consumption.

Despite growing empirical evidence of the health risks associated with EDs, many countries do not enforce age-specific restrictions on these drinks. Thus, there is a need to identify other strategies to minimize harm to children. Although efforts to reduce young peoples' ED consumption requires evidence to inform the development of comprehensive policy and practice interventions, little is known about the correlates of ED consumption among youth. The few prior studies of ED use in this age group have investigated correlations with behavior,^{3,5} with alcohol either when mixed with EDs or when consumed separately,^{6–9} and most recently correlates of ED use initiation.⁴ A more in-depth investigation of factors associated with ED consumption in this vulnerable population is necessary to extend the literature, and this investigation would be the first of its kind in Australia. Consequently, the main objective of this study was to use a socioecological approach to identify the individual, social, and environmental factors associated with adolescent ED intake, using data collected from a large sample of Western Australian secondary school students participating in the AMPED UP: An Energy Drink Study.

METHODS

The AMPED UP: An Energy Drink Study collected data from secondary school students in grades 7 to 12 (aged 12–17 years) during class time, using a 67-question online survey. Survey questions (described below and shown in the Table^{10–12}) were adapted from the 2015 Canadian Adolescent and Young Adult ED Survey by Hammond et al.¹³ To establish the reliability of all survey items, a test-retest reliability analysis was performed. The 2 tests were delivered 1 week apart using a convenience sample of 150 adolescents aged 12–17 years. Reliability was determined using intraclass correlations when the measurement scale of the item

was continuous and kappa statistics when the measurement scale of the item was categorical/binary. Moderate agreement was defined as 0.40–0.60, good agreement as 0.61–0.80, and excellent agreement as > 0.80.¹⁴ Only items with good to excellent reliability were included in the final survey.

School and Student Selection

All Western Australia (WA) secondary schools were divided into low or high socioeconomic status on the basis of their Index of Community Socio-Educational Advantage score (ie, above or below 1,000).¹⁵ Schools were randomly selected from each stratum and invited to participate until 25 schools agreed to participate (95 schools were invited; 26% school response rate).

Data were collected between October 2017 and July 2018. In each of the 25 participating schools (26% school response rate), all 7th- to 12th-grade students were invited to complete the survey (except 3 schools only able to invite specific year levels). Student participation ranged from 10% to 66% of the entire school and was higher in the high Index of Community Socio-Educational Advantage schools.

Ethics Approval

This study was conducted according to the guidelines laid down in the Declaration of Helsinki, and all procedures involving research study participants were approved by The University of Western Australia, WA Department of Education, WA Catholic Education Office, and the Association for Independent Schools of WA. A study information brochure and consent form were sent to each school principal, participating child, and parent/guardian to inform them about the study. Written consent was obtained from each school principal and participating child and their parent/guardian.

Energy Drink Consumption

Participants were asked, "Have you ever tried an energy drink, even a few sips?" (don't know, no, yes). Those

who responded "yes" were subsequently asked, "When was the last time you had an energy drink, even just a few sips?," followed by 7 options ranging from "don't know" to "in the last 24 hours." Participants were then classified as an ED user if they selected "in the last 30 days," "in the last 7 days," or "in the last 24 hours."

Correlates of ED Consumption

Nineteen single items measuring individual ($n = 12$; sociodemographic factors, knowledge, and perceptions of ED, sensation-seeking personality type), social ($n = 3$; having friends and/or parents who drink EDs, having parents with permissive ED attitudes), and environmental factors ($n = 4$; availability of EDs in the home, exposure to ED marketing, school location, school socioeconomic status) were examined (see the Table^{10–12} for a full list and description).

Statistical Analyses

Of the 3,837 surveys received, 149 provided incomplete data leaving 3,688 surveys available for analysis. Descriptive statistics were used to describe each variable. Statistical analysis was conducted using SPSS software (version 25, IBM Corporation, 2017). Each individual, social, and environmental variable was tested for a univariate association with being an ED user (Model 1) using logistic regression, and nonsignificant variables (defined as $P > 0.10$) were excluded from further analyses. A backward stepwise logistic regression analysis was then used to construct a model of statistically significant correlates (defined as $P < 0.05$) of being an ED user (Model 2), adjusted for clustering at the school level. The correlation between all explanatory variables was tested to ensure a variance inflation factor score < 5 , which indicated that the estimates were not biased by multicollinearity.

RESULTS

Participant characteristics are shown in the Table^{10–12}. Overall, 18% of adolescents ($n = 664$) reported consuming an ED within the past 30 days.

Model 1 in the Table^{10–12} presents univariate associations between individual, social, and environmental factors and ED use. With the exception of 4 individual factors (ie, age, family affluence, and educational messages [binary and continuous]), all individual, social, and environmental factors were significantly associated with being an ED user in univariate models (all $P < 0.05$) and were subsequently included in the multivariate logistic regression model (Model 2).

Five individual, 2 social, and 1 environmental factor remained significantly associated with being an ED user in the final multivariate model (Table^{10–12}) (Model 2). Factors associated with increased odds of being an ED user included having EDs available in the home (odds ratio [OR], 4.00; 95% confidence interval [CI], 2.86–5.55), having friends who drank EDs (OR, 2.88; 95% CI, 2.16–3.83), having parents who would give them an ED if they asked them to (OR, 2.63; 95% CI, 2.04–3.45), perceiving EDs to be safe for someone their age to drink (OR, 1.69; 95% CI, 1.37–2.08), being male (OR, 1.54; 95% CI, 1.27–1.86), perceiving EDs to be good for health (OR, 1.41; 95% CI, 1.03–1.92), having a higher disposable income (OR, 1.19; 95% CI, 1.11–1.28), and having a sensation-seeking personality (OR, 1.04; 95% CI, 1.01–1.07).

DISCUSSION

This study found EDs to be a popular beverage choice among adolescents, with around 1 in 5 reporting consuming an ED within the past month.¹⁶ Factors associated with being an ED user (in order of effect size) included having EDs available at home, having friends who drank EDs, having parents who would give them EDs if they asked, perceiving EDs to be safe for someone their age, being male, perceiving EDs to be good for health, having a higher disposable income, and having sensation-seeking personality traits.

The prevalence of ED use among this study's Australian adolescent sample was similar to previous research investigating adolescents in Canada,¹⁷ US,¹⁸ and Turkey,¹⁹ where past month ED prevalence estimates ranged from

17.9% to 31.1%. Similarly, the finding that ED use was more prevalent among males than among females supports previous studies.^{17,20} The popularity of EDs among young males may be related to the marketing and advertising of EDs, which tend to be targeted toward males by using hypermasculine characteristics and emphasizing athleticism, militarism, dominance, and power.^{21,22}

This study found that the home environment, peers, and parents were key influences of adolescent ED consumption, which corroborates findings from previous qualitative research in Australian adolescents.²³ This finding also supports Social Cognitive Theory²⁴ whereby people's actions are the result of observing, reinforcing, and subsequently modeling the behavior of influential others in their environment.

Perceiving EDs to be safe for someone their age to drink and perceiving EDs to be good for health were both associated with being an ED user. These findings suggest adolescent ED users wrongly perceive EDs as safe for them to drink and therefore have incorrect information about EDs to make informed choices. Other studies have also reported young people to be unaware or misinformed about the potential health effects and nutritional content of EDs and concluded that educational interventions were needed.^{23,25}

The current finding of an association between ED consumption and sensation-seeking behavior is consistent with previous evidence drawn from Canadian and Turkish adolescents, which found sensation-seeking was higher among ED users than nonusers.^{17,19,26,27} Sensation-seeking is a personality trait characterized by "the need for varied, novel, and complex sensations and experiences and the willingness to take physical and social risks for the sake of such experiences."²⁸ Given that sensation-seeking individuals are drawn to high-risk activities, the popularity of EDs among this group may be related to how they are advertised and marketed. Such marketing is often centered around high-risk activities, such as extreme sporting events, motorsport racing, and rock concerts.^{29–31} Currently, it is unknown

whether individuals with sensation-seeking traits are drawn to EDs or whether consuming EDs leads to higher sensation-seeking behaviors (or both) and which type of intervention strategies would have the most impact on reducing or preventing ED consumption among this subgroup.

This study found that having a higher disposable income was associated with an increased likelihood of being an ED user. This finding suggests that adolescents might be using their disposable income from employment to purchase EDs—possibly with the intention of getting an energy boost to meet the demands of work along with their other commitments. Further research is needed to gain a deeper understanding of how adolescents obtain EDs and their perceptions around cost. This information may help inform whether economic strategies to increase the price of EDs (eg, through taxation³²) would be successful in reducing ED consumption or whether it would be more effective to introduce other comprehensive strategies to reduce access and availability (eg, an outright ban to those aged under 18 years).

The authors used the social ecological model to advance research in to the factors associated with adolescent ED consumption.³³ Strengths include its large sample size, wide age-range of adolescents, incorporation of metropolitan and regional areas, and reliable survey items. However, this study's cross-sectional design means causality, and the direction of associations cannot be determined. Thus, it is unclear whether sensation-seeking individuals are drawn to EDs or whether EDs lead to sensation-seeking behaviors. There is also a risk of selection bias (because of active consent) and recall and social desirability bias because the survey was self-reported and the classification of ED use relied on adolescents' recalling their previous intake. Although this study included a wide range of individual, social, and environmental correlates ($n = 19$) believed to be associated with ED intake, it is possible that other important correlates exist that were not included in our study.

Table. Individual, Social, and Environmental Factors Associated With Being an ED User (AMPED UP Study, Western Australia, October 2017–July 2018)

Factors	Variable	Model 1: ED User (Univariate Results)			Model 2: ED User (Multivariate Results)		
		All Participants (N = 3,688)	No (n = 3,017)	Yes (n = 664)	P	OR (95% CI)	P
Individual factors							
Sex, %	Female	55.1	85.8	14.2	<0.001	1.54 (1.27–1.86)	<0.001
	Male	44.9	77.3	22.7			
Age (y), mean (SD)		14 (2)	14 (2)	14 (2)			
School grade level, %	Lower secondary (7th–9th)	71.0	82.8	17.2	0.04		
	Upper secondary (10th–12th)	29.0	79.9	20.1			
Employment status, %	Not employed	79.8	83.7	16.3	<0.001		
	Employed seasonally, casually, or part time	20.2	75.2	24.8			
Disposable income, mean (SD)		2.49 (1.55)	2.39 (1.48)	2.94 (1.76)	<0.001	1.19 (1.11–1.28)	<0.001
Family affluence tertile, % Composite score of 5 items adapted from the Family Affluence Scale II ¹⁰ and III ¹¹ recoded into tertiles (low, medium, high).	Low affluence	22.9	82.1	17.9	<0.001		
	Medium affluence	39.2	83.6	16.4			
	High affluence	37.9	80.2	19.8			
Can identify at least one ingredient in EDs, % Participants were asked, “What do you think are the main ingredient(s) in energy drinks that give the energy boost?” Responses were recoded into, “Can identify at least one ingredient in energy drinks - yes vs no.”	No	21.3	78.2	21.8	<0.001		
	Yes	78.7	85.4	14.6			
Perceives EDs as good for health, % Participants were asked, “Do you think energy drinks are. . .” “very good for your health, good for your health, neither good nor bad, bad for your health, very bad for your health, don’t know,” then recoded into “Perceives energy drinks as good for health” yes (very good for your health, good for your health) or no (neither good nor bad, bad for your health, very bad for your health, don’t know).	No	78.7	87.6	12.4	<0.001	1.41 (1.03–1.92)	0.009
	Yes	21.3	70.1	29.9			
Has heard an educational message warning about the potential health risks of EDs, % Participants were asked, “Have you seen or heard any educational messages that warn about the potential health risks of energy	No	27.9	83.0	17.0			
	Yes	72.1	84.6	15.4			

(continued)

Table. (Continued)

Factors	Variable	Model 1: ED User (Univariate Results)			Model 2: ED User (Multivariate Results)		
		All Participants (N = 3,688)	No (n = 3,017)	Yes (n = 664)	P	OR (95% CI)	P
drinks?" Response options (select all that apply) were "no, yes (school/TV/radio/newspaper or magazine/poster or billboard/online or internet/social media/store/somewhere else [please specify]), or don't know." Responses were recoded into no (if no and/or don't know for all) or yes.							
Number of educational messages, mean (SD)		2.11 (2.20)	2.08 (2.14)	2.26 (2.49)	0.08		
Participants were asked, "Have you seen or heard any educational messages that warn about the potential health risks of energy drinks?" Affirmative responses to yes (school/TV/radio/newspaper or magazine/poster or billboard/online/internet/social media/store/somewhere else [please specify]), were summed. Possible range 0-9.							
Perceives it to be safe for someone their age to drink EDs, %	No	83.8	87.3	12.7			
Participants were asked, "Is it safe for someone your age to drink energy drinks?" Recoded as yes (definitely safe, probably safe) or no (in the middle, probably not safe, definitely not safe, don't know).	Yes	16.2	67.4	32.6	<0.001	1.69 (1.37–2.08)	<0.001
Sensation-seeking personality, mean (SD)		12.06 (3.90)	11.89 (3.80)	12.99 (4.33)	<0.001	1.04 (1.01–1.07)	0.011
Composite score of 4 items based on brief measure of sensation-seeking by Hoyle et al. ¹² Possible range 0-20, the higher the score, the higher the sensation-seeking, defined as "the need for varied, novel, and complex sensations and experiences and the willingness to take physical and social risks for the sake of such experiences."							
Social factors							
Do you have any friends who drink EDs?, %	No/Don't know	38.3	94.8	5.2			
	Yes	61.7	77.3	22.7	<0.001	2.88 (2.16–3.83)	<0.001

(continued)

Table. (Continued)

Factors	Variable	Model 1: ED User (Univariate Results)			P	Model 2: ED User (Multivariate Results)	
		All Participants (N = 3,688)	No (n = 3,017)	Yes (n = 664)		OR (95% CI)	P
Parents/caregivers drink EDs, % Participants were asked, "How often do your parents/caregivers drink energy drinks?" Responses were recoded into parents/caregivers drink energy drinks as no (never) or yes (not often, sometimes, often, always).	No	63.0	91.0	9.0	<0.001		
	Yes	37.0	72.1	27.9			
Parents would give me an ED if I asked, % Participants were asked, "If you were to ask your parents/caregivers for an energy drink, how often would they give you one?" Responses were recoded into "Parents would give me an energy drink if I asked," no (never) or yes (not often/sometimes/often/always).	No	50.0	94.4	5.6	<0.001	2.63 (2.04–3.45)	<0.001
	Yes	50.0	73.6	26.4			
Environmental factors							
EDs available in the home, % Participants were asked, "How often do you have energy drinks available in your home?". Responses were recoded into "energy drinks available at home," no (never) or yes (not often, sometimes, often, always).	No	66.2	93.3	6.7	<0.001	4.00 (2.86–5.55)	<0.001
	Yes	33.8	65.7	34.3			
School socioeconomic status (ICSEA), %	High	50.3	87.9	12.1	<0.001		
	Low	49.7	76.0	24.0			
School location, %	Metro	77.3	82.8	17.2	0.01		
	Regional	22.7	79.0	21.0			
No. of marketing strategies, mean (SD) Participants were asked, "Have you ever seen any of the following?" Affirmative responses to energy drink ads on TV, social media, online/on the internet, magazines or newspapers, posters or signs in shops, free samples, merchandise give-aways, branded cars/vehicles, in movies, music videos, video games were summed. Possible range 0-20.		7 (3)	6 (2)	7 (3)	<0.001		

CI indicates confidence interval; ED, energy drink; ICSEA, Index of Community Socio-Educational Advantage; OR, odds ratio.

IMPLICATIONS FOR RESEARCH AND PRACTICE

The findings of this study suggest initiatives to reduce or prevent the consumption of EDs among adolescents should target parents and adolescents and be multifaceted, addressing individual and social factors and access to EDs in the home.

Parents may be unaware of the potential health risks associated with ED use in adolescents and the potential impact their ED use might be having on their child (ie, having EDs available within the home). More research is needed to understand parental knowledge, beliefs, and attitudes toward EDs, to inform the development of parent resources aimed at preventing and reducing children's ED consumption. In terms of other social factors, such as peer influence, educating young people has been found to be effective in helping them resist peer pressure to engage in harmful activity in other contexts.³⁴ For example, an education-based life skills program for adolescents was found to help participants resist peer pressure to use tobacco and drink alcohol.^{35,36}

The present findings also suggest educational interventions targeting adolescents are needed to reverse misconceptions about EDs. Educational interventions addressing health consequences have been shown to be effective at reducing sugar-sweetened beverage consumption among adolescents aged 12–17 years.³⁷ However, having seen or heard an educational message about EDs or the number of educational messages recalled were not significantly associated with being an ED user in our final model. Thus, it may be more impactful if educational interventions target both adolescents and parents, given the key role parents and the home environment were shown to play in the current study.

Further research on ED-specific educational interventions is warranted because there appear to be no studies that have considered them. A recent review of caffeine use in children and adolescents suggested that harm-reduction strategies should include campaigns to educate on the

potential harms of EDs using tailored messages for the target audience and be supported by health professionals such as medical practitioners, dietitians, and nurses.³⁸ Evidence from public health interventions in school settings for other harmful commodities may also be useful in informing ED harm-reduction strategies. For example, a review of prevention and reduction of substance use (tobacco, alcohol, and illicit drugs) interventions in schools suggests that consideration of the developmental stages of early, middle, or late adolescence may be relevant in the planning of prevention programs.³⁹

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