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Patterns of Energy Drink Use and Associated Symptoms Among a Population of Connecticut Factory Workers

To the Editor:

Caffeinated energy drinks (CEDs) are new and increasingly popular beverages with possible concerning health effects.¹⁻⁹ With the rise in consumption of CEDs, there has been a concurrent rise in the number of emergency room visits related to adverse reactions and/or co-consumption with other substances.^{1,7} In addition to caffeine, CEDs contain vitamins, amino acids, and herbs.¹⁰ Consumers are often unaware of the ingredients in CEDs beyond caffeine or of their potential adverse health effects.¹¹

The most commonly reported adverse effects of CEDs include sleep disturbance, racing heart, headache, stomach upset, and nervousness.^{1,4,9,12} There are also reports of seizures and deaths.^{1,4,9} Consumption of CEDs has been correlated with decreased sleep in night-shift workers¹³ and poor quality sleep in female Japanese workers.¹⁴ Also of concern to factory workers, caffeine may alter thermoregulation and fluid balance during periods of exercise.^{2,15}

Recognizing the potential adverse health effects of CEDs, their use in the workplace may be of concern. On routine pre-employment testing, we unexpectedly found elevated serum creatinine levels (range, 1.8 to 2.0) with normal blood urea nitrogen (BUN) levels in several factory workers. History revealed increased amino acid intake

through CED consumption. Return to normal creatinine levels after cessation of CEDs supported the conclusion that elevations were attributable to recent CED consumption. This finding prompted us to survey workers on their CED consumption habits and associated symptoms.

METHODS

The company is located in an unair-conditioned factory building. In addition to standing during most of their work shifts and heavy lifting, workers are exposed to a number of solvents and chemicals in the production of textiles.

We surveyed 53 workers, or 52.5% of the population, via questionnaire during a recess in a worker safety training program in September of 2015. The questionnaire included baseline demographic information, consumption of CEDs (frequency of use, type of energy drinks consumed, use at work), and co-consumption of other substances including tobacco, alcohol, soda, and coffee. The survey also assessed self-rated health, concentration, and energy levels. In addition, the survey assessed prevalence of symptoms potentially related to CED consumption^{1,4,9} including: restlessness, palpitations, anxiety, hallucinations, irritability, dry mouth, headache, dry mouth, thirst, heat intolerance, difficulty concentrating, abdominal pain, diarrhea, tremors, seizures, and fatigue.

Using Microsoft Excel and SAS software (v. 9.4, SAS Institute, Cary, NC), we calculated descriptive statistics and analyzed data for associations using chi-squared test for categorical data, and *t* test for comparing means in continuous data.

RESULTS

Thirty six (68%) of factory workers had consumed CEDs, of whom 56% consumed them within 1 week and 72% within 1 month of the survey (recent consumers). The CEDs most commonly consumed were Monster (74%) followed by Red Bull (46%). Among recent (last month) consumers, most consumed CEDs at work versus home or other settings (Fig. 1). Fifty percent of recent drinkers reported drinking CEDs twice weekly or more. Fifty percent of recent drinkers reported combining CEDs with tobacco products and 19% reported combining them with alcohol (data not shown).

Table 1 provides a comparison between recent (last month) and past or never CED consumers. Recent CED users

were younger than never or past consumers. While not statistically significant, recent drinkers were more commonly Hispanic or Black, and past or never drinkers were more likely to be White ($P = 0.09$). Recent CED drinkers were significantly more likely to report average or above average energy levels than past or non-drinkers and were also significantly more likely to report experiencing thirst in the last month. Job-related factors such as job type, shift, and job location did not differ significantly between groups. Self-reported health status and concentration did not differ significantly among recent and past/never CED consumers. Recent CED consumers more commonly reported headache, anxiety, and insomnia in the last month (Table 1).

DISCUSSION

Consumption of CEDs has been associated with adverse health effects,^{1,4,9} which may impact worker safety and performance in the work environment. This cross-sectional survey explored the prevalence and associated symptoms related to CED use in a population of workers in one factory. We found that CED consumption was common in this population, and that most drinkers consumed CEDs at work. CED consumers were younger, and were more commonly Hispanic or Black than non-consumers. Recent consumers were also significantly more likely to report higher energy levels. Workers commonly combined CED use with the use of other substances including tobacco and alcohol. Symptoms of thirst, headache, insomnia, and anxiety were more common among those who recently consumed energy drinks.

Our finding that CED consumers were younger correlates with national survey data reporting that CED consumption is highest in adolescents and young adults.¹⁶ Similarly, the concurrent use of other substances is not surprising as, in a survey of adolescents, tobacco use and alcohol consumption were strong predictors of CED consumption.⁵

While not statistically significant, recent CED consumers tended to be more likely Hispanic or Black than non-drinkers. Work-related factors such as job type, shift, and job location were not associated with CED consumption. In a study of construction workers, however, CED use was correlated with overtime work, positive beliefs around CED consumption, and advertisement-related motivation.¹⁷ As 65% of recent consumers drank CEDs at work,

Mellisa A. Pensa is a fellow in the YOMEP, which is funded by NIH Grant #5T03OH008607, Occupational Safety, and Health Training Project. YOMEP has a service contract with the manufacturing facility described in this paper. No additional sources of funding or conflicts of interest were declared by remaining authors.

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DOI: 10.1097/JOM.0000000000000728

FIGURE 1. Percent of recent CED consumers (last month) reporting drinking CEDs at work, home, in social settings, or other settings.

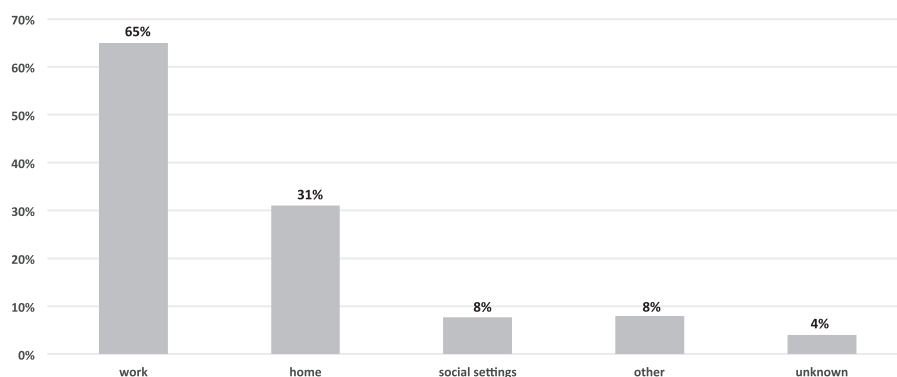


TABLE 1. Demographic and Self-Reported Health Factors in All, Recent Energy Drink Consumers, and Past or Never Consumers

	All N = 50	Recent (≤ 1 month) N = 26	Past/Never (> 1 month) N = 24	Significance
Category	Mean (range)	Mean (95% CI)	Mean (95% CI)	P value*
Age (years)	40.3 (23–63)	36.3 (32.5–40.1)	44.8 (40.4–49.2)	0.004
Category	n (%)	n (%)	n (%)	P value†
Race/Ethnicity				
Hispanic	34 (68)	20 (77)	14 (58)	0.09
Black	7 (14)	5 (19)	2 (8)	
White	6 (12)	1 (4)	5 (21)	
Asian	2 (4)	0	2 (8)	
Sex				
Male	48 (96)	26 (100)	22 (92)	0.13
Job type				
Machine operator	30 (60)	14 (54)	16 (67)	0.35
Other	20 (40)	12 (46)	8 (33)	
Shift				
1 st	21 (42)	9 (35)	12 (50)	0.50
2 nd	18 (36)	10 (39)	8 (33)	
3 rd	11 (22)	7 (27)	4 (17)	
Floor				
Basement	20 (40)	9 (35)	11 (46)	0.36
1 st	15 (30)	8 (27)	7 (29)	
Other	3 (6)	3 (35)	0	
Unknown	12 (24)	6 (23)	6 (25)	
Self-rated health				
Excellent	13 (26)	5 (19)	8 (33)	0.21
Good	27 (54)	16 (62)	11 (46)	
Fair	7 (14)	5 (19)	2 (8)	
Poor	1 (2)	1 (5)	0	
Unknown	2 (4)	0	2 (8)	
Self-rated energy				
High or very high	17 (34)	9 (35)	8 (33)	0.01
Average	25 (50)	17 (65)	8 (33)	
Low or very low	5 (10)	0	5 (21)	
Unknown	3 (6)	0	3 (13)	
Self-rated concentration				
High or very high	16 (32)	9 (35)	7 (29)	0.44
Average	27 (54)	15 (58)	12 (50)	
Low or very low	5 (10)	2 (8)	3 (13)	
Unknown	2 (4)	0	2 (8)	
Symptoms				
Any	19 (38)	13 (50)	6 (25)	0.17
Unknown	3 (12)	3 (12)	3 (13)	
Thirst	10 (20)	9 (35)	1 (5)	
Headache	6 (12)	4 (15)	2 (8)	

TABLE 1. (Continued)

Category	n (%)	n (%)	n (%)	P value [†]
Insomnia	4 (8)	3 (11)	1 (4)	0.63
Anxiety	5 (10)	4 (15)	1 (4)	0.41
Heat intolerance	2 (4)	2 (8)	0	0.38
Fatigue	3 (6)	0	3 (13)	0.17

CI, confidence interval.

^{*}Significance reported for *t* test comparing means.[†]Significances reported for chi-square test.

we suspect there may be work-related factors contributing to consumption that our survey did not reveal. Physical demands including heat and exertion may be triggering thirst that prompts the choice to consume these refreshments. Furthermore, coworker influence and work culture may influence the decision to consume CEDs, as behaviors such as food choices, tobacco, and alcohol use are influenced by social connections.^{18–22}

Few studies assess symptoms related to CED consumption in workers,^{13,14} and ours is the first to our knowledge to address symptoms in a population of United States workers. Our cross-sectional data show that CED consumption is significantly associated with thirst and higher self-reported energy levels. As reported in previous studies,^{4,7,12} we found headache, insomnia, and anxiety are more common among CED consumers, but not statistically significantly so.

Thirst may be triggering consumption of CEDs, or thirst may be a symptom of dehydration related to the diuretic effect of CEDs.¹⁵ Regarding self-reported energy levels, it is unclear if workers who have higher energy are drawn to CEDs or if the beverages increase perceived energy levels. Effects of CEDs on performance are mixed.^{8,15}

Our study is limited by its small sample size. Additionally, our English language questionnaire was distributed in a group setting, and many participants whose first language was not English may not have sought clarity. Further investigation is needed to determine if CEDs cause these associated and other symptoms in workers, including injury risk. Additional investigation is needed to understand potential confounding factors.

We suspect that the choice to consume CEDs is related to a host of factors, including work-related influences and social factors. We also suspect that CED consumption may contribute to adverse

health effects in the workplace. Future research may further elucidate work-related factors contributing to CED consumption, potential health effects, and the need for preventive interventions.

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