



Age restriction warning label efficacy and high school student consumption of highly-caffeinated products[☆]

Jonathan Goldman, Meng'ou Zhu, Tammy B. Pham, Ruth Milanaik*

Division of Developmental and Behavioral Pediatrics, Steven and Alexandra Cohen Children's Medical Center of New York, New Hyde Park, New York, United States

ARTICLE INFO

Keywords:
Age restriction warning label
Adolescents

ABSTRACT

Age restriction warning labels (ARLs) are placed on highly-caffeinated food and drinks, such as Red Bull, to deter consumption by minors who are especially vulnerable to the risks of excessive caffeine consumption. Previous studies have shown that ARLs on media like TV programs and video games fail to discourage minors. However, it is unclear how ARLs on food and drink packages affect minors' purchasing behavior. High school students aged 14 to 17 years ($n = 150$, $M_{\text{age}} = 15.2$, 51% male) were asked to choose between seven novel product dyads (three food/drink dyads, two movie dyads, and two video game dyads); each dyad contained one product with an ARL and one without. Participants were then asked how ARLs and parental permissiveness of ARL products influenced their decision. Roughly half of the participants selected food and drink products with ARLs. Over two-thirds (69%) of the students reported that they were not discouraged by ARLs on highly caffeinated food and drinks. Participants reported their parents as significantly less permissive of age-restricted food and drink products than of age-restricted media merchandise ($p < .01$). Perceived parental permissiveness was not correlated with minors' perception of ARL or simulated product choice. Current ARLs on highly caffeinated food and drink items may be ineffective for adolescents and may actually increase product appeal. Pediatricians should educate patients and parents regarding the health risks of excessive caffeine consumption.

1. Introduction

In the United States, age restriction warning labels (ARLs) such as “not recommended for children” are placed on adult-oriented TV programs, movies, and video games. Recently, ARLs have also been placed on highly caffeinated energy products. While these products are marketed for young adults, a report conducted by three senators suggested that most manufacturers of these highly caffeinated age-restricted food and drinks do not avoid marketing their products to minors (Sifferlin, 2015). Companies of many highly caffeinated energy products sponsor popular sporting events and celebrities for promotion purposes, which result in tremendous product appeal to minors (Caygill, 2016). Such age-restricted food and drink items often contain high dosages of

caffeine and have been associated with caffeine overdose, seizures, diabetes, cardiovascular abnormalities, diuresis, dehydration, insomnia, and behavioral disorders (Seifert et al., 2011; Iyadurai & Chung, 2007; Candow et al., 2009). While the Food and Drug Administration (FDA) has limited the caffeine content in drinks to 65 mg per 12 oz, a significant subset of these age-restricted food and drink items are classified as dietary supplements, which are not subject to the same FDA regulations (McCusker et al., 2006). Spike Energy Drink, for example, contains 350 mg caffeine per 16 oz can (Spike Energy, 2017). Between 2004 and 2012, the FDA's Center for Food Safety and Applied Nutrition Adverse Event Reporting System recorded 92 voluntary and mandatory reports of adverse events associated with energy drink consumption, including 13 deaths (US Department of Health and

Abbreviations: ARL, age restriction warning label; FDA, Food and Drug Administration

[☆] Table of contents summary: age restriction warning labels on highly caffeinated food and drink items fail to deter teenagers and potentially entice their purchase behavior.

What we know: age restriction warning labels displayed on media merchandise, such as movies and video games, often fail to deter minors from making purchases and potentially encourage their purchase behavior.

What this study adds: age restriction warning labels not only failed to deter minors, but instead encouraged some to choose highly-caffeinated, performance-enhancing foods and drinks. Pediatricians should counsel and educate both patients and parents on the health consequences of caffeine intake and overdose.

* Corresponding author at: Division of Developmental and Behavioral Pediatrics, Steven and Alexandra Cohen Children's Medical Center of New York, 1983 Marcus Avenue Suite 130, Lake Success, NY 11042, United States.

E-mail address: RMilanaik@northwell.edu (R. Milanaik).

<https://doi.org/10.1016/j.pmedr.2018.05.018>

Received 10 January 2018; Received in revised form 17 April 2018; Accepted 27 May 2018

Available online 30 May 2018

2211-3355/ © 2018 Published by Elsevier Inc. This is an open access article under the CC BY-NC-ND license

(<http://creativecommons.org/licenses/by-nc-nd/4.0/>).

Human Services, 2013). Adolescents have a lower tolerance for caffeine than adults and are more susceptible to the risks associated with excessive caffeine consumption (Seifert et al., 2011). Additionally, caffeine can potentially interfere with neurologic and cardiovascular development in children (Nawrot et al., 2003). Given the health risks associated with caffeine, pediatricians generally discourage even small amounts of daily caffeine intake (Seifert et al., 2011; Nawrot et al., 2003). In an effort to address this health issue, several states have made unsuccessful legislative attempts to put age restrictions on energy drink sales (K.Y. Legis. H., 2008; M.D. Legis. H., 2014). Therefore, it is concerning that 30–50% of adolescents report consuming highly caffeinated age-restricted energy drinks (Seifert et al., 2011).

Popular highly caffeinated food and drink brands, such as 5-Hour ENERGY, Rockstar, and Red Bull, include a discrete body of text on food packaging stating that their products are “not recommended for children, pregnant women, or individuals who are sensitive to caffeine” (5-Hour Energy, 2016). However, it is unclear how these ARLs influence minors' buying decisions. Although ARLs warn parents against buying certain products for children, minors who make purchases by themselves—direct consumers—might actually be enticed by such labels. In fact, several studies have shown that ARLs on video games and movies may entice minors to use/view more “grown-up” products (Bijvank et al., 2009; Bushman, 2006).

To date, no study has investigated the influence of ARL on minors' food and drink purchasing decisions. In the present study, a sample of high school students were asked to choose between dyads of novel, unfamiliar product images of 1) an item with an ARL and 2) another item without an ARL. We aim to study how ARLs on food and drink items influence the buying decisions of adolescents. This study also examines the association between parental permissiveness of age-restricted products and adolescent purchase behaviors.

2. Methods

2.1. IRB statement

High School IRB and Northwell IRB jointly approved the research.

2.2. Study design

One hundred and fifty adolescents aged 14–17 from an upper-socioeconomic high school in a suburb in the New York metropolitan area were asked to fill out an anonymous survey ($M_{\text{age}} = 15.2$, 51% male, 100% response rate). There were over 1000 students enrolled in the high school, with the student population being 60% White, 15% Asian, 10% Black, 6.9% Hispanic, and 8.1% mixed race.

The survey was comprised of four parts. Part 1 asked participants to indicate their age, gender, frequency of food/drink purchases, and TV/video game usage. The frequency options included “Every day”, “4–6 times a week”, “1–3 times a week”, and “Less once a week”. Part 2 included 14 different products presented in 7 dyads: one energy drink dyad, one energy bar dyad, one “energy shot” dyad, two video game dyads, and two movie dyads. No real products were used; all products were created and photo-edited by researchers to prevent bias from previous exposure. The media products (i.e. video games and movies) were included in this study as controls to validate the methodology. Each dyad included two analogous products with similar names using pictures downloaded from free stock prints on the Internet. In each dyad, one product was randomly chosen to contain an ARL. To simulate mainstream ARL in the market, we used common warning messages and images often observed on age-restricted products. One dyad was limited to each page so each dyad could be considered individually. This survey was presented in paper form and the students were prompted to flip one page at a time. The images were 5.5 in. in length and 3 in. in width. The ARL was placed visibly and was 0.75 in. in height and 1.25 in. in width. It read “Restricted to 18 and over” with an

1a. ARL used for study



1b. Actual ARL on ARL product

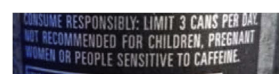


Fig. 1. a and b. Restricted label used for study with comparison of actual restricted label.

R 18+ graphic. This graphic is much larger and more prominent than those on actual products (see Fig. 1). Of note, on actual energy drink products these warnings occur in the same font and color as ingredients and are not readily visible to consumers. The clear display of these warning labels was essential to the study design so these warning labels were made clearly visible and easy to understand. Actual ESRB (Entertainment Software Rating Board) warning M for “Mature” was placed on all video games and R-rating labels were placed on movies. Participants were asked to choose only one of the two products shown in each dyad. To avoid product bias, one group of participants received dyads containing ARLs on one half of the products, while the other group of participants received the same dyads with ARLs on the other half of the products (Fig. 2). The dyads and the products within each dyad were presented in random order so order effects would not be a confounding variable. In Part 3, the participants were asked to categorize each of their seven choices based on the following options: “The ARL encouraged my choice”, “The ARL discouraged my choice”, or “I did not notice the ARL.” In Part 4, the participants were asked “Do your parents allow you to watch R-rated movies?”, “Do your parents allow you to play M-rated video games?”, and “Do your parents allow you to drink ARL energy drinks?” in order to assess parental permissiveness of various products.

2.3. Statistical analysis

Statistical analyses were performed using *R*. To elucidate the effect of ARL on product selections, the percentage of teenagers that selected the ARL product from each dyad was tested against the hypothesis that “50% of the respondents would select the ARL product” using a one-sample *t*-test.

Seven linear regressions, one for each dyad, were conducted to determine the association between parental permissiveness and teenage product selection. In each regression, the response variable was a binary value that indicated whether or not the minor selected the ARL product from a dyad, and the independent variable was a binary indicator of parental permissiveness of the category corresponding to each dyad (movies, video games, or caffeinated energy products). Another seven linear regressions were conducted in a similar fashion to determine the association between parental permissiveness and whether minors were encouraged by, discouraged by, or did not notice the ARL when making decisions for each dyad. The results for energy drink, energy bar, and energy shots were averaged for simplicity, and a detailed breakdown for each food/drink dyad can be found in Fig. 3.

A 2-sample *t*-test was used to determine the impact of gender on the number of age-restricted products each respondent selected from each of the seven dyads.

3. Results

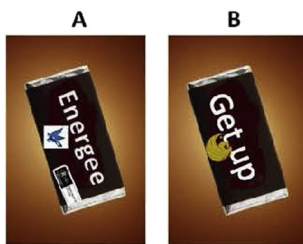
Across the 150 respondents, a significant percentage were frequent direct consumers (indicating they personally purchased products directly from vendors, without parental influence, four or more times a week): 46% reported buying food, 39% bought drinks, 58% watched TV/movies, and 23% played video games ≥ 4 times/week.

Overall, minors chose age-restricted products over half (55%) of the time. For the caffeinated food and drink dyads, roughly half of the teens

Please choose only one of the following energy shots:



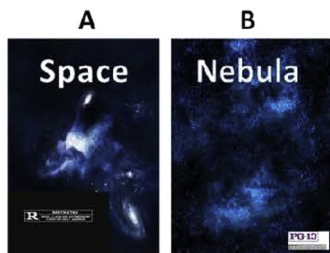
Please choose only one of the following energy bars:



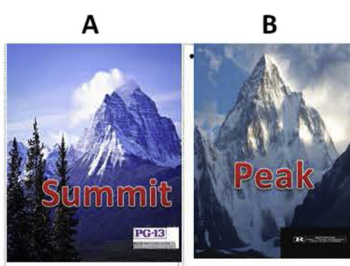
Please choose only one of the following energy drinks:



Please choose only one of the following movies:



Please choose only one of the following movies:



Please choose only one of the following video games:



Please choose only one of the following games:



Fig. 2. The seven novel product dyads presented to respondents.

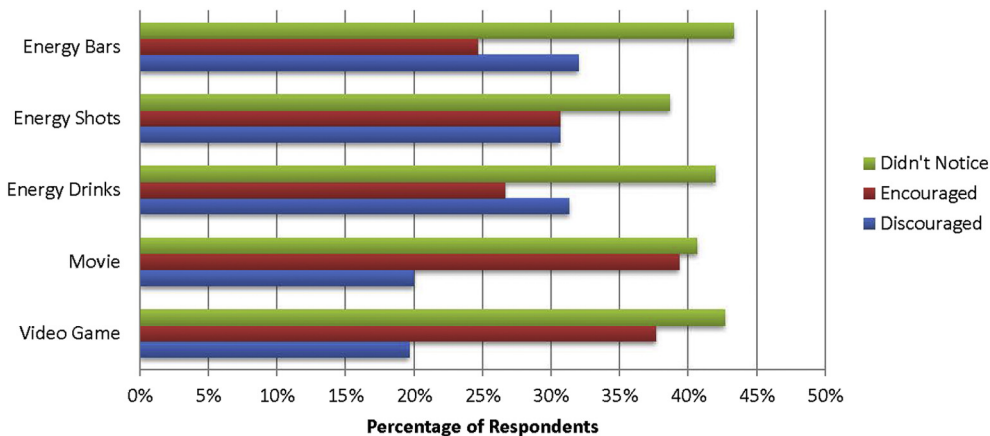


Fig. 3. How ARL affected minors' choice of age-restricted products.

selected the ARL product (Energy bar: 55%, $p = .25$; Energy shot: 45%, $p = .19$; Energy drink, 47%, $p = .52$). For both movie dyads, more than half of the teenagers chose the ARL product (*Peak* vs. *Summit*: 64%, $p < .001$; *Space* vs. *Nebula*: 65%, $p < .001$). For both video-game dyads, slightly more than half of the teenagers chose the ARL product, but the difference was not significant (*Simile* vs. *Metaphor*: 55%, $p = .25$; *Trek* vs. *Hike*: 57%, $p = .1$).

Fig. 3 shows the percentage of participants who were “encouraged by”, “discouraged by” or “didn’t notice” the ARL when choosing between products in each dyad category. The data for the two movie dyads and the two video-game dyads were combined due to their similarity in response patterns. For 69% of the students, ARLs on food and drink items were either not noticed (41%) or taken as an encouragement (27%) for choosing the restricted product. Similarly, only 19.7% of the participants were deterred by ARLs when selecting age-restricted video games, and only 23% of the m were deterred when selecting age-restricted movies.

There was no significant difference between males and females in the frequency of selecting age-restricted products (3.77 vs. 3.96, $p = .34$). There was also no gender difference in the frequency of each respondent’s product choices that were discouraged (1.66 vs. 1.79, $p = .70$) or encouraged (2.21 vs. 2.53, $p = .40$) by ARLs.

In terms of parental permissiveness, 32% of the parents were reported as permissive of energy drinks, 87% were permissive of age-restricted movies, and 80% were permissive of age-restricted games. No significant correlation between permissiveness and choice of products was observed.

4. Discussion

Prior to this study, researchers had investigated the impact of ARL on minors’ purchase behavior regarding video games and movies (Bijvank et al., 2009; Bushman, 2006). They concluded that ARLs on media did not work as effectively as expected, and may in turn entice minors to purchase restricted products (Bijvank et al., 2009; Bushman, 2006). Our results indicate that ARLs on age-restricted, highly caffeinated food and drink packages may not be adequate product choice deterrents. Had ARLs been effective, more than half of the teenagers in this study would have refrained from choosing the age-restricted product; however, the opposite was shown for all seven dyads. While results may be interpreted as consistent with free choice, it should be noted that based on the high percentage of minors who selected the restricted food and drink items, ARLs presented on the packages of highly caffeinated food and drink items clearly failed to effectively deter minors. Since more than a third of surveyed minors were self-reported direct purchasers of food and drinks, the failure of ARL as an effective deterrent may actually expose minors to the risks of high doses of caffeine in age-restricted food and drink items. Additionally, Fig. 3 demonstrates that most respondents did not notice the ARLs on food or drink items or media products despite being clearly labeled in the study. The majority of real energy drinks are not clearly labeled; instead, the warning is included near the nutritional information in the same font and font color as other information (Fig. 1). Among those who did notice ARLs, a portion of respondents worryingly reported that ARLs encouraged their selection of age-restricted products. As more age-restricted products with potentially harmful ingredients enter the market, this problem may continue to grow.

Of note, we deliberately did not use current products on the market in this study. In reality, the age-restricted food and drink items on the current market often have even greater appeal among young teens due to product endorsements by celebrities and sports figures. As minors associate Monster Energy Drink with X Games and Red Bull with Formula One (Caygill, 2016), they perceive these products as more appealing. The increased appeal may compound with peer pressure, resulting in increased purchasing of highly caffeinated age-restricted food and drinks (Costa et al., 2014). Additionally, there are possibly

interactions with previous experience and ARLs that shape teen choice in both the positive and negative direction. If an adolescent is a frequent energy drink consumer and is aware of the ARLs, they may assume that a product with an ARL will be more similar to one they have consumed in the past and, thus, base their decision accordingly or vice versa.

It is also noteworthy that although child-reported, over a third of parents were reported as permissive of these ARL products. This result indicates that a concerning percentage of parents may not be aware of the health risks associated with highly caffeinated age-restricted food and drink items. As we did not inquire whether parents were indeed aware, it is impossible to determine whether parents heed these warnings.

These results are extremely concerning because they imply that many minors may be legally purchasing highly caffeinated food and drink items that are labeled with age restriction warning labels. Based on the limitations of current ARLs identified in our study, we offer the following suggestions for the future presentation of ARLs. First, given the high percentage of minors who claim to not notice ARLs on packages, companies should make ARLs more apparent. Second, a concerning number of minors report that ARLs encouraged them to select age-restricted products. To combat this issue, the text and warning messages of ARLs should be revised with careful consideration. Previous studies on ARLs associated with TV programs and video games suggested that ARLs tend to work more effectively when they include detailed information about the content and risk of the product (Bushman, 2006). Similarly, the warning messages of highly caffeinated food and drinks should not consist of top-down commands, but rather should clearly state the health risks (Brehm, 1966). It is advisable to inform all customers of the potential consequences of caffeine overdose and present warning labels as “information labels” to discourage minors from making these purchases. Additionally, pediatricians should educate patients and their parents about the dangers of highly caffeinated food and drinks (Schneider & Benjamin, 2011).

There are several limitations to this study. The artificial scenario presented in the questionnaire may not have perfectly simulated real-world transactions. Minors were only asked about which product they would pick out of each of the seven dyads and may not have purchased such age-restricted products in real life. In addition, since each respondent filled out the surveys independently, this study does not take into account the peer group influence that could potentially alter the purchase decisions of minors. As the high school IRB was restrictive on the types of questions that could be asked of the students, we were unable to further elicit each student’s personal history of energy drink intake or other personality traits that may have led to further insights into those teens who may have chosen/not chosen ARL products. Future studies should include personality and purchasing history questions in order to determine if ARL choice patterns exist. In addition, the racial composition of the school and the socioeconomic status of the students somewhat limit the generalizability of the findings. Despite these limitations, the data suggests that ARLs did not effectively deter and may actually encourage a small subset of adolescents to consume highly caffeinated age-restricted food and drinks.

5. Conclusion

Age-restricted warning labels on food and drink items did not deter minors from choosing age-restricted products and actually enticed some teens in the study. We recommend that future research examine actual teen purchase behavior and assess which types of ARLs would most deter minors from purchasing such products. The implementation of ARLs on highly caffeinated age-restricted food and drink items should also be accompanied by education by pediatricians. We also hope that more detailed regulations and suggestions for ARL design will be considered in order to better implement age restriction warnings.

Funding source

This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors.

Financial disclosure

The authors have no financial relationships relevant to this article to disclose.

Conflict of interest

The authors have no conflicts of interest to disclose.

Acknowledgments

The corresponding author affirms all those who contributed substantially to the work have been listed. J.G designed and conducted the survey and drafted the article. M.Z and TP contributed to data analysis and revised the article. This project was presented at the AAP NCE and the SDBP Annual Meeting in 2016.

References

- 5-Hour Energy, 2016. How to Use 5-hour ENERGY® Shots. <http://5hourenergy.com/facts/how-to-use/> (Accessed 11/21/).
- Bijvank, M.J., Elly, A.K., Brad, J.B., Peter, H.M.P.R., 2009. Age and violent-content labels make video games forbidden fruits for youth. *Pediatrics* 123 (3), 870–876.
- Brehm, J.W., 1966. *A Theory of Psychological Reactance*. Academic Press, New York.
- Bushman, B.J., 2006. Effects of warning and information labels on attraction to television violence in viewers of different ages. *J. Appl. Soc. Psychol.* 36 (9), 2073–2078.
- Candow, D., Kleisinger, A., Grenier, S., Dorsch, K., 2009. Effect of sugar-free red bull energy drink on high-intensity run time-to-exhaustion in young adults. *J. Strength Cond. Res.* 23, 1271–1275.
- Caygill, C., 2016. Max Verstappen, F1's Next Great Superstar, Shows Why Red Bull Made the Move on Him. *The National Sport*. <http://www.thenational.ae/sport/formula-one/max-verstappen-f1s-next-great-superstar-shows-why-red-bull-made-the-move-on-him>, Accessed date: 8 February 2017.
- Costa, B.M., Hayley, A., Miller, P., 2014. Young adolescents' perceptions, patterns, and contexts of energy drink use. A focus group study. *Appetite* 80, 183–189.
- Iyadurai, S., Chung, S., 2007. New-onset seizures in adults: possible association with consumption of popular energy drinks. *Epilepsy Behav.* 10, 504–508. <https://doi.org/10.1016/j.yebeh.2007.01.009>.
- K.Y. Legis. H, 2008. An Act Relating to Energy Drinks. General Assembly Session 2007–2008, HB374.
- M.D. Legis. H, 2014. Criminal Law – Energy Drinks – Sale to and Possession by Minors Prohibited. General Assembly Session 2013–2014, HB1273.
- McCusker, R.R., Goldberger, B.A., Cone, E.J., 2006. Caffeine content of energy drinks, carbonated sodas, and other beverages. *J. Anal. Toxicol.* 30 (2), 112–114.
- Nawrot, P., Jordan, S., Eastwood, J., Rotstein, J., Hugenholtz, A., Feeley, M., 2003. Effects of caffeine on human health. *Food Addit. Contam.* 20 (1), 1–30.
- Schneider, M.B., Benjamin, H.J., 2011. Sports drinks and energy drinks for children and adolescents: are they appropriate? *Pediatrics* 127 (6), 1182–1189.
- Seifert, S.M., Schaechter, J.L., Hershoin, E.R., Lipshultz, S.E., 2011. Health effects of energy drinks on children, adolescents, and young adults. *Pediatrics* 127 (3), 511–528.
- Sifferlin, A., 2015. Most Energy Drink Companies Market to Minors, Report Finds. *TIME Health*. <http://time.com/3661633/most-energy-drink-companies-market-to-minors-report-finds>, Accessed date: 22 February 2017.
- Spike Energy, 2017. Spike® Hardcore Energy, Original (16 oz) 24. <https://spikeenergy.com/product/spike-hardcore-energy-original/> (Accessed 2/10/).
- US Department of Health and Human Services, 2013. Voluntary and Mandatory Reports on 5-hour Energy, Monster Energy, and Rockstar Energy Drink. Food and Drug Administration. (Retrieved Oct, 28).