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Exploring the Potential for Graphic Warning Labels to Reduce Intentions to Consume Energy Drinks

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ABSTRACT

Issue Addressed: Effective interventions to reduce energy drink (ED) consumption are needed. This study explored the effect of warning labels on intentions to reduce ED consumption, perceived label effectiveness and protection motivation theory (PMT) constructs.

Methods: Australian ED consumers aged 18 to 39 years ($N = 343$) participated in an experimental online survey, randomly assigned to view one of three ED warning label conditions (weight gain, cardiac effects, no label—control). Intentions to reduce ED consumption, perceived effectiveness of labels and selected PMT constructs were assessed.

Results: Participants reported moderate-high awareness of the health effects of consumption (62.68%) and advisory statements on EDs (69.39%), including daily consumption limits (48.40%). EDs were consumed frequently, with 56.26% regular (at least weekly) consumers and most commonly for functional benefits (e.g., alertness). ED warning labels did not have a statistically significant effect on intentions to reduce consumption. The cardiac label performed better than the weight gain label in 'grabbed attention' (72.97% vs. 55.66%, $p = 0.008$), with non-significant trends ($p > 0.05$, absolute differences $\geq 10\%$) suggesting it was stronger on some other perceived effectiveness measures. Supplementary analyses indicated females in the cardiac condition reported greater intentions to reduce ED consumption than females in the control condition ($p = 0.042$).

Conclusions: Graphic warning labels and labels warning of cardiac effects are worthy of further exploration as a potential intervention to reduce ED consumption.

So What? Future research should explore the motivations underlying ED consumption and further explore messages that will resonate with consumers.

1 | Introduction

The rapid increase in the popularity of energy drinks (EDs), particularly among adolescents and young adults, represents a growing public health risk. A recent systematic review and meta-analysis of global prevalence indicated a high level of lifetime ED use, particularly among adolescents and young adults; with use ranging from daily (8.82%) to past 12 months (54.7%)

[1]. EDs often contain caffeine in high quantities (up to 160 mg of caffeine per 500 mL in Australia), as well as sugar, guarana, taurine and B complex vitamins [2]. Adverse reactions and toxicity from ED consumption are primarily the result of their caffeine content [3]. Excessive caffeine intake can result in the effects of caffeine intoxication, which include tachycardia, vomiting, palpitations, arrhythmias, seizures and exacerbation of psychiatric conditions [4, 5]. The caffeine content of EDs has also been found to increase the risk of heart disease [6]. Additionally, EDs often contain large amounts of added sugar. The consumption of sugar-sweetened beverages (SSBs) is associated with tooth decay, weight gain, Type 2 diabetes, metabolic syndrome, cardiovascular disease, hypertension, stroke, dehydration and asthma [7–9].

Given that EDs are linked to numerous adverse health effects, reviews of regulatory guidelines and interventions to reduce consumption of the beverage are warranted [3]. Falling under general food laws, the manufacturing and distribution of EDs in Australia must comply with Standard 2.6.4 of The Australia New Zealand Food Standards Code [10]. This stipulates that EDs must not contain more than 320 mg/L of total caffeine and must display a declaration of the quantity of caffeine per serving size and per 100 mL. In addition, they must display advisory statements to the effect that: the beverage contains caffeine and certain substances beyond caffeine; it is not recommended for children, pregnant or breastfeeding women and individuals sensitive to caffeine; and the daily limit of the beverage expressed as mL, cans or bottles.

However, current advisory statements which are displayed in small font on the back of packaging are likely to be insufficient to inform consumers of the health effects of ED consumption [11]. While the Food Standards Code requires EDs to include caffeine declarations and advisory statements, there is no mandate on the design, size, font or placement of this information, and it can be included in a somewhat hidden manner, along with nutritional information on the back or side of the product, which is often not attended to and poorly understood by consumers [12, 13].

The effectiveness of front-of-package (FoP) warning labels in informing consumers and encouraging reduced SSB consumption is supported by real-world evidence and many experimental studies, with systematic reviews demonstrating effectiveness [14–18]. These studies have demonstrated that warning labels can attract attention and elicit psychological responses underlining behaviour change, such as an increase in negative attitudes and an increase in perceived risk, and subsequently reducing consumption intentions and behaviours [19]. However, the potential of warning labels to reduce ED consumption requires further investigation. To date, few studies have assessed the potential of ED warning labels (provided information about the caffeine content or health effects of EDs) to influence consumers' consumption intentions and have incorporated text-only labels exclusively [20, 21]. Thus, further studies are required despite these promising results.

Protection motivation theory (PMT) [22] is a theoretical framework that describes the process by which individuals are motivated to protect themselves when faced with a perceived threat [23]. The core assumption of PMT suggests that appraisal of one's risk can motivate individuals to act on that risk. This appraisal process first involves perceptions of fear, then threat appraisal and coping appraisal. During threat appraisal, individuals weigh the severity of the threat (perceived severity) and whether they are personally at risk (perceived vulnerability). During coping appraisal, individuals assess the degree to which the recommended response will effectively avert the threat (response efficacy), the degree to which they have the capability to do what is required (self-efficacy) as well as any perceived cost incurred by performing the protective action (response costs). In experimental studies involving PMT, the independent variable is manipulated through fear appeals, which take the form of messages communicating potential threats, with intentions assessed as outcomes indicative of message effectiveness [24].

Studies based on the PMT framework have shown that persuasive messages that evoke fear can motivate people to engage in protective behavioural intentions engendering actual behavioural change [24, 25]. However, the PMT model has not been applied in the context of ED consumption, and specifically, as a framework to guide understanding of consumers' reactions when exposed to messages communicating the negative health effects associated with ED consumption. Current evidence on effective warning labels in SSBs indicates that the optimal design of a warning label should include pictures depicting the adverse health effects associated with the consumption of the product [26]. Given the potential for greater effectiveness with the addition of graphic elements, it is beneficial to examine graphic warning labels in the context of EDs. This study draws on key aspects of PMT and investigates the extent to which individuals are motivated to reduce intentions to consume EDs in response to different health effects messaging or warning labels, as compared to viewing no label.

The health effects explored in this study include cardiac conditions (depicted as heart palpitations and heart disease) and weight gain. PMT posits that intentions to reduce ED consumption may be greater if individuals perceive the observed health threat as having a more severe impact. In the context of this present study, heart palpitations and heart disease are considered the more severe health effects, as the cardiovascular conditions are considered as having more acute impacts compared to weight gain and are depicted using a more 'grotesque' medical image (Figure 1). PMT constructs, e.g., perceptions of: susceptibility, effectiveness of the protective response, self-efficacy to change behaviour, response cost and fear, will be explored under this context.

In addition to PMT constructs, consumers' perceptions of the effectiveness of health messages or perceived effectiveness have been found to be predictive of intentions to improve health behaviour and subsequent behaviour change [27, 28]. Perceptions of effectiveness (e.g., persuasiveness) are often assessed as an indicator of the potential of warning labels or health messages and campaigns to influence beneficial changes in mechanisms underlying longer-term behaviour change [29]. A prior study compared the perceived effectiveness of text-only warning labels on EDs and found a greater

FIGURE 1 | Respective ED can for the control, weight gain and cardiac effects label conditions.

proportion of participants perceived a cardiac label as 'believable' and 'relevant' in comparison to an obesity label, but that labels were equivalent in terms of being easy to understand, making them 'stop and think' and providing new information [21]. This study will determine consumers' perceptions of the effectiveness of graphic warning labels to add to the limited available evidence on the potential of such intervention to reduce ED consumption.

The primary aim of this study was to compare the relative effectiveness of two different ED graphic warning labels in encouraging intentions to reduce ED consumption and compare this with a control (no warning label). This study also explored whether PMT constructs were associated with intentions to reduce ED consumption and the extent to which PMT constructs (perceived severity, perceived vulnerability, fear, response efficacy and response costs) and perceived label effectiveness differed between label conditions.

2 | Method

2.1 | Participants

Eligible participants were adults aged between 18 and 39 years who were fluent in English, residing in Australia, indicated they or their family members were not employed in the beverage industry and had at least occasional ED consumption, that is, reported ED consumption in the past 3 months, consistent with a previous ED study [30].

Participant recruitment was conducted via paid advertisements on Facebook over a 4-week period from the 3rd to 31st of May 2021 and snowball sampling (word of mouth/social media sharing). An incentive to participate was offered by providing participants with the chance to win one of three $50 gift vouchers. First-year psychology students were also recruited from X

University (removed for blind review) and were granted course credit for taking part in this study. A sample size of $n = 300$ participants was the recruitment target to be equally divided between the three ED warning label conditions ($n = 100$ per group) based on a priori power analysis assuming a Type I error rate of $\alpha = 0.05$, 80% power and medium effect size.

2.2 | Study Design

This study was a between-subject online experiment that randomly assigned participants to one of three ED warning label conditions (or groups): control group (no label), weight gain label and cardiac label. Each WL was displayed to participants on an ED can and enlarged above to facilitate readability on screen (see Figure 1). The graphic warning labels were designed to be as similar as possible, using the same dimensions, design and wording, differing only in the adverse health effects they depicted. All three conditions were presented using the same ED can which was photographed by the researcher. The position and lighting were kept consistent to ensure images closely resembled one another across conditions with the exception of the labels.

2.3 | Procedure

After indicating informed consent, participants completed screening questions to determine eligibility. Eligible participants completed the main questionnaire (ED consumption behaviour, awareness of warning messages and knowledge of adverse health effects) and then were randomly allocated to one of the warning label conditions. They were then shown an image of an ED reflecting their condition (no label, weight gain label, cardiac label). Finally, all participants completed measures assessing PMT constructs and demographic characteristics.

2.4 | Measures

2.4.1 | ED Consumption Behaviours

Assessment of ED consumption was based on an SSB consumption question from a previous study [31]. Participants were asked frequency of ED consumption (daily, weekly, monthly or less than monthly) and whether they also consumed alcohol on days that they consumed EDs. Participants were also asked about the volume consumed in millilitres on days that they consumed EDs and to indicate the most amount of ED they have ever consumed in 1 day. Based on a previous soft drink consumption study [32], participants were asked about their perception of the amount of ED they consume (too much, just right, not enough or do not know). Participants were asked to indicate their motivations for consuming EDs from a list of 13 potential responses.

2.4.2 | Awareness of Current Advisory Statements and Knowledge of Health Effects

Participants were asked whether they were aware of current advisory statements on EDs. Those who answered 'yes' were asked to record the statements in as much detail as they could in a text box. The written response was coded for correctness by the lead author. Participants' knowledge of health effects was assessed through the question 'Do you know of any illnesses or health effects associated with drinking energy drinks?' with 'yes' and 'no' as the response choices, based on the assessment of knowledge of health effects of SSB consumption in previous studies [31, 33]. If participants indicated 'yes', they rated, from a prompted list in a fixed order, the extent to which they perceived various health effects were associated with drinking EDs.

2.4.3 | PMT Constructs

Measures of PMT constructs (Table 1) were based on that of an existing study [24], which were adapted from previous studies employing an empirical research design based on the theoretical foundations of PMT [34, 35]. Questions were modified to assess the variables described in the research model of the present study. All questions were rated on seven-point Likert scales instead of five-point scales as seven-point scales were found to provide a more accurate measure of a participant's true evaluation and are more appropriate for online questionnaires [36]. Participants were asked to indicate their level of agreement with a series of statements by selecting from (1) Strongly disagree' to (7) 'Strongly agree'. Certain items were reverse-scored for analysis.

2.4.4 | Perceived Label Effectiveness

Measures of the perceived effectiveness of graphic labels were adopted from previous tobacco and ED studies [21, 29]. Participants were asked to rate their agreement with various statements regarding the ED warning label: 'grabs my attention', 'is easy to understand', 'is believable', 'makes me stop and think', 'taught me something new' and 'is relevant to me', with possible responses: (1) 'strongly disagree' to (5) 'strongly agree'. Similarly, participants were asked to rate the effectiveness of the warning label in: 'Making people think about the health effects of energy drinks', 'Discouraging people from wanting to drink energy drinks' and 'Overall, how effective is this packaging?' with possible responses: (1) 'not at all effective' to (5) 'very effective'. Responses were dichotomised to non-agreement/less effective (1–3) and agreement/more effective (4, 5) for analysis to facilitate interpretation, similar to the approach utilised in an analysis of perceptions of sugary drinks labels in another recently published study [37].

2.4.5 | Demographic Characteristics

The survey also collected information regarding participants' demographic characteristics. Participants were asked to report their age, gender, highest qualification, as well as their height and weight, which allowed for the calculation of body mass index (BMI). Postcodes were also collected and were used to ascertain participants' socio-economic status according to Socio-Economic Indexes for Areas [38], which ranks areas in Australia according to their relative socio-economic disadvantage scores. Disadvantage deciles were dichotomised into 'more disadvantaged' (1–5) and 'less disadvantaged' (6–10).

2.5 | Statistical Analysis

Statistical analyses were conducted in IBM SPSS version 27. PMT variables did not follow a normal distribution, therefore continuous data were analysed using Kruskal–Wallis H tests to compare mean ranks between conditions. For categorical outcomes (perceived effectiveness), a series of binary logistic regressions were conducted to determine differences in outcomes between weight and cardiac conditions. For completeness, supplementary analyses were conducted comparing mean ranks (Mann–Whitney tests) of perceived effectiveness between conditions, and with dichotomised outcomes for PMT constructs (logistic regressions), with results available from Supporting Informatics. Overall, results were generally consistent with the exception of a few findings, which are highlighted in the text. Correlations (Spearman's rho) assessed associations between intentions and PMT variables.

Results of a prior study found that responses to ED text warning labels differed when examined within gender subgroups; [21] therefore, exploratory analyses were also conducted to determine whether intentions to reduce consumption in response to graphic warning labels on EDs differed when examined separately within selected subgroups (gender, age, socio-economic status, BMI, highest qualification, consumption and knowledge of health effects). A series of Kruskal–Wallis tests were conducted to compare the difference in intentions (mean ranks and proportions of participants with higher intentions) across conditions within each subgroup. Supplementary analyses with the dichotomised outcome (intentions to reduce consumption) are also reported in Supporting Informatics for completeness.

3 | Results

In total, 343 participants were included in the analyses. There were no cases of missing values except for the 1.17% of participants

TABLE 1 | Measures of PMT constructs and internal consistency (Cronbach's alpha).

Measure	Items	α
Perceived severity (weight)	1. If I were to gain weight, my life will be affected 2. Gaining weight would be unlikely to cause me any major concern	0.70
Perceived severity (cardiac)	1. If I were to develop heart palpitations and heart disease, my life will be affected 2. Heart palpitations and heart disease would be unlikely to cause me any major concerns	0.43
Perceived vulnerability (weight)	1. My chances of gaining weight are high 2. I am unlikely to gain weight	0.90
Perceived vulnerability (cardiac)	1. My chances of developing heart palpitations and heart disease are high 2. I am unlikely to develop heart palpitations and heart disease	0.82
Fear (weight)	1. I am worried about the prospect of gaining weight 2. I am frightened about the prospect of gaining weight 3. I am anxious about the prospect of gaining weight 4. I am scared about the prospect of gaining weight	0.97
Fear (cardiac)	1. I am worried about prospect of developing heart palpitations and heart disease 2. I am frightened about prospect of developing heart palpitations and heart disease 3. I am anxious about prospect of developing heart palpitations and heart disease 4. I am scared about prospect of developing heart palpitations and heart disease	0.96
Response efficacy (weight)	1. Reducing my consumption of EDs is a good way to reduce the risk of weight gain 2. If I were to cut back on the amount of energy drinks I drink, I would lessen my chance of gaining weight	0.86
Response efficacy (cardiac)	1. Reducing my consumption of energy drinks is a good way to reduce the risk of developing heart palpitations and heart disease 2. If I were to cut back on the amount of energy drinks I drink, I would lessen my chance of developing heart palpitations and heart disease	0.90
Self-efficacy	1. Reducing my consumption of energy drinks is easy 2. Reducing my consumption of energy drinks would not bother me 3. I am able to reduce my consumption of energy drinks without much effort	0.40
Response costs	1. The benefits of reducing my consumption of energy drinks outweigh the cost 2. I would be discouraged from reducing my consumption of energy drinks because it would be too much trouble 3. Reducing my consumption of energy drinks would cause me problems	0.63
Intentions	1. I intend to reduce my consumption of energy drinks 2. I do not wish to reduce my consumption of energy drinks	0.86

(control $n=1$, weight $n=2$, cardiac $n=1$) who did not provide the postcodes of their residences, which were used to determine their socio-economic status. Table 2 reports participant characteristics for the whole sample and by label conditions. Results of Pearson's chi-square analyses indicated that there were no significant differences in participant characteristics between the three conditions.

3.1 | ED Consumption Behaviours and Knowledge

Participants' ED consumption, awareness of current advisory statements and knowledge of health effects were assessed prior to exposure to warning labels (see Table 3). Of the 343 participants included in the analyses, 25.07% of participants reported consumption that exceeded the recommended daily limit on days that they consumed EDs (500 mL). More than one-fifth of the sample reported consuming EDs daily. Less than 40% of the overall

sample reported they also consumed alcohol on days that they consumed EDs, less than half of whom reported consuming EDs in combination with alcohol. The most frequently selected reason for consuming EDs was to help stay awake or concentrate for work or study. Approximately two-thirds of participants reported that they were aware of the current advisory statements on ED packaging, with a high proportion of these participants able to correctly or partially correctly recall at least one theme unprompted. As shown in Table 3, the most frequently recalled theme regarding current advisory statements was related to the recommended daily limit.

3.2 | Differences in Outcomes Between Label Conditions

There were no significant differences in perceived severity (weight gain and cardiac), perceived vulnerability (weight gain

		Label condition			
	Total	**Control**	**Weight**	**Cardiac**	
Demographic	**n (%)**	**n (%)**	**n (%)**	**n (%)**	**χ^2**
Gender[a]					
Men	178 (51.90)	67 (53.17)	59 (55.66)	52 (46.85)	3.744
Women	152 (44.31)	54 (42.86)	43 (40.57)	55 (49.55)	$p = 0.711$
Age group					
18–24	231 (67.35)	84 (66.67)	66 (63.26)	81 (72.97)	2.869
25–39	112 (32.65)	42 (33.33)	40 (37.74)	30 (27.03)	$p = 0.238$
SES quintile[b]					
More disadvantaged	167 (48.69)	68 (53.97)	49 (46.23)	50 (45.05)	2.150
Less disadvantaged	172 (50.15)	57 (45.24)	55 (51.89)	60 (54.05)	$p = 0.341$
BMI					
Normal/underweight	192 (55.98)	77 (61.11)	56 (52.83)	59 (53.15)	2.133
Overweight/obese	151 (44.02)	49 (38.89)	50 (47.17)	52 (46.85)	$p = 0.344$
Highest qualification[c]					
Secondary school or Less	129 (37.61)	45 (35.71)	44 (41.51)	40 (36.04)	
Some tertiary/completed vocational training	170 (49.56)	66 (52.38)	47 (44.34)	57 (51.35)	1.715
Finished university (bachelor's degree or higher)	41 (11.95)	14 (11.11)	14 (13.21)	13 (11.71)	$p = 0.944$

[a]3.8% of participants (control $n = 5$, weight $n = 4$, cardiac $n = 4$) identified as neither man nor woman, or did not declare their gender, and are not included in this analysis.
[b]1.17% of participants (control $n = 1$, weight $n = 2$, cardiac $n = 1$) did not declare the postcodes of their residences and are not included in this analysis.
[c]0.87% of participants (control $n = 1$, weight $n = 1$, cardiac $n = 1$) did not specify their highest qualification obtained and are not included in this analysis.

and cardiac), fear (weight gain and cardiac), response efficacy (weight gain and cardiac), self-efficacy, response cost and intention scores between those in the control condition, those in the weight gain label and cardiac label condition (Table 4). Results of supplementary logistic regression analyses with PMT variables as dichotomous outcomes indicated that those in the weight gain label condition reported higher self-efficacy (OR = 0.56, 95% CI: [0.38, 0.99], $p = 0.045$) and response costs (OR = 0.55, 95% CI: [0.30, 1.00], $p = 0.049$) than those in the control condition (see Table S1).

With respect to perceived effectiveness measures, participants perceived the cardiac more highly (absolute difference in proportions of 10% or more) on the extent to which the label grabbed attention, made the participant stop and think, makes people think about the health effects of consumption and discourages people from consuming these drinks. However, the only statistically significant difference was for the 'grabbed attention' item (significantly higher among those who viewed the cardiac label than those who viewed the weight gain label).

Further exploratory analyses were conducted to identify differences in intentions across labels within selected subgroups (Table 5). Overall, there were no statistically significant differences in intentions between label conditions among gender, age, socio-economic status, BMI or highest qualification subgroups.

However, results of supplementary logistic regression analyses with the intention to reduce ED consumption as a dichotomous outcome (lower mean intentions (1–4) vs. greater mean intentions (5–7)) indicated that among females, those in the cardiac condition were more likely to report greater intentions to reduce consumption than those in the control condition (OR = 2.23, 95% CI: [1.03, 4.48], $p = 0.042$; see Supporting Information and Table 2).

Moderate positive significant ($p < 0.01$) Spearman's rho correlations were found between intentions to reduce consumption and: response efficacy$_{weight}$ $r = 0.50$, fear$_{cardiac}$ $r = 0.41$, response efficacy$_{cardiac}$ $r = 0.42$ and response cost $r = 0.43$. Weak positive correlations were found between intentions and perceived vulnerability$_{weight}$ $r = 0.15$, fear$_{weight}$ $r = 0.16$, perceived severity$_{cardiac}$ $r = 0.16$ and perceived vulnerability$_{cardiac}$ $r = 0.20$.

4 | Discussion

The need for interventions to reduce ED consumption is a relatively recent public health agenda. Research spanning over 40 years has shown that FoP warning labels promote safe consumer behaviour in a wide range of products [26]. There is an increasing body of evidence indicating the effectiveness of warning labels as an intervention to reduce SSB consumption,

TABLE 3 | Consumption frequency, alcohol consumption, reasons for consuming energy drinks, awareness of health effects associated with energy drink consumption and awareness of current advisory statements ($n = 343$).

	No.	%
Consumption frequency[a]		
Less than once per month	72	20.99
1–3 times per month	78	22.74
Once per week	35	10.20
More than once per week	80	23.32
Daily	78	22.74
Alcohol consumption on days they drink energy drinks		
No	211	61.52
Yes	73	21.28
Yes, combined consumption of energy drinks and alcohol	59	17.20
Reasons for consuming energy drinks[b]		
To stay awake or to help concentrate for work or study	279	81.34
To feel awake in general (not for any specific activity)	239	69.70
For the taste	227	66.18
To cope with a lack of sleep	210	61.22
For going out/partying	155	45.19
To mix with alcohol	154	44.90
To stay awake or alert for driving	128	37.32
To boost energy while playing video games	85	24.78
To increase physical performance	79	23.03
To help sobering up or with hangovers after drinking alcohol	67	19.53
Rehydration	55	16.03
To help lose weight or help keep weight off	37	10.79
Awareness of health effects associated with ED consumption		
No	128	37.32
Yes	215	62.68
Awareness of current advisory statements		
No	105	30.61
Yes	238	69.39
Advisory statement recall ($n = 238$)[c]		
Correct/partially correct recall	205	86.13
Incorrect recall/do not know	33	13.87
Correct recall of advisory statement themes[b] ($n = 205$)		
Daily limit	166	48.40
Not recommended for pregnant or lactating women	133	38.78
Caffeine content	62	18.08
Not recommended for children	40	11.66

(Continues)

TABLE 3 | (Continued)

	No.	**%**
Not recommended for individuals sensitive to caffeine	39	11.37
Consume responsibly	7	2.04
Incorrect recall of advisory statement themes[d] ($n = 33$)		
Heart effects	36	10.50
Do not know	21	6.12
Do not consume with alcohol	8	2.33
Other[d]	9	2.62

[a]Percentages may not total 100 due to rounding.
[b]Participants could select or be coded across multiple items.
[c]Only participants who have answered 'Yes' to awareness of current advisory statements (68.39%) were asked to recall statements.
[d]Other themes relate to ED ingredients (i.e., taurine, phenylalanine), health effects (i.e., blood sugar increase) and overdose.

in both real-world and experimental settings [14–18]. However, evidence demonstrating the potential impact of labels, and in particular graphic warning labels, on ED consumption is limited. This study determined the potential of graphic warning labels to reduce intentions to consume EDs and compared the relative perceived effectiveness of different health messages. The results indicated that exposure to graphic warning labels did not result in greater intentions to reduce ED consumption than viewing no label. These findings were not consistent with that of previous SSB studies, which found that warning labels significantly reduced the selection of SSBs compared to the control condition [39, 40], and that different health messages varied in terms of their impact on the choice of SSBs [41].

While the present study sample was not representative of the Australian population or all ED consumers, the study results indicate there are concerning practices regarding the consumption of EDs among some consumers. Among this limited sample of consumers, it was evident that consumption was frequent and high for many consumers, with frequent reports of exceeding the recommended daily limit (500 mL) on days of ED consumption. Consuming alcohol with EDs was also a common practice among this sample. There were moderate levels of awareness of health effects associated with ED consumption in the sample and of the current advisory statements on ED packaging, with the most frequently recalled theme relating to the recommended daily limit.

Despite the null effects, there are several reasons why FoP warning labels on EDs warrant further research and may still have promise as a tool to reduce consumption. Participants assigned to the experimental conditions were only briefly exposed to the health messages. To produce a more realistic picture of warning labels, evidence suggests that such controlled experiments should involve longer exposure [42]. Furthermore, successful campaigns to motivate behaviour change are multifaceted, as the coordination of different strategies can exhibit powerful synergy and achieve greater success in health promotion [43]. Therefore, FoP warning label is only one factor of a multifaceted approach to informing consumers and encouraging reduced consumption.

ED consumers may also be different from SSB consumers, which may explain the demonstrated effectiveness of SSB warning labels and the lack of effect observed in this study. More specifically, there may be unique drivers underlying ED consumption that make ED consumers more resistant to health messages. While technically falling under the category of SSBs, consumers perceive the EDs as functional products that serve practical purposes. This is evident in how the sample of ED consumers involved in this study reported various utilitarian reasons for consuming the beverage (i.e., to help concentrate on work or study). In fact, higher percentages of the participants reported consuming EDs for functional purposes than recreational purposes (i.e., going out/partying). Similar to how motives underlying smoking may prevent attempts at cessations, such as stress relief in motivating continued smoking [44], the perceived functionality and enjoyment of EDs may have inhibited motivations to reduce consumption and mitigated the potential impact of the graphic warning labels. The impact of hedonistic motives, such as perception of enjoyment and positive consumer identity, is also likely to inhibit behaviour change, similar to the finding that enjoying smoking and liking being a smoker have been identified as particular barriers to making a quit attempt [44]. Understanding the factors underlying ED consumption among consumers could prove useful in designing targeted motivating messages to discourage consumption.

Previous ED research has shown that intentions to reduce ED consumption varied with consumer profile [20]. Results of exploratory subgroup analyses, when conducted separately for label conditions, indicated that mean intentions to reduce ED consumption did not differ significantly according to viewing the weight or cardiac label. However, supplementary analyses indicated that among females, those in the cardiac condition had greater intentions to reduce consumption than those in the control condition. This finding is consistent with several previous studies regarding the effects of gender on health information processing, as this gender difference can be explained by the fact that women are more likely to engage with nutrition labels and health information on food packaging than men [45], and that women are more likely to avoid food products due to perceived unhealthiness [46].

A secondary aim of this study was to compare participants' perceptions of the effectiveness of the different graphic warning label types, as perceived effectiveness was found to predict

TABLE 4 | Summary of differences in intentions and PMT variables and difference in dichotomised perceived effectiveness measures by label condition.

PMT Variables ($n = 343$)	Control Mean Rank $n = 126$	Weight Mean Rank $n = 106$	Cardiac Mean Rank $n = 111$	Kruskal-Wallis χ^2	p
Perceived severity (weight)	175.91	164.55	174.67	0.890	0.641
Perceived vulnerability (weight)	166.09	184.91	166.38	2.629	0.269
Fear (weight)	175.77	169.36	170.23	0.295	0.863
Response efficacy (weight)	172.66	171.54	171.68	0.009	0.995
Perceived severity (cardiac)	177.80	168.60	168.66	0.724	0.696
Perceived vulnerability (cardiac)	166.85	189.62	161.02	5.181	0.075
Fear (cardiac)	179.87	177.74	157.59	3.525	0.172
Response efficacy (cardiac)	184.01	165.25	164.82	2.985	0.225
Self-efficacy	182.59	155.40	175.83	4.638	0.098
Response cost	182.86	159.95	171.18	3.102	0.211
Intentions to reduce consumption	171.77	173.12	171.19	0.220	0.989

Perceived effectiveness of label ($n = 217$)	%	%	Logistic regression (1 = agreement vs. 0 = non-agreement) OR (95% CI)[a]	
Grabbed attention	55.66	72.97	2.15 (1.22–3.80)	0.008
Easy to understand	94.34	89.19	0.50 (0.18–1.37)	0.176
Believable	55.66	57.66	1.13 (0.66–1.93)	0.666
Made consumer stop and think	36.79	49.55	1.69 (0.98–2.90)	0.059
Taught something new	31.13	29.73	0.94 (0.53–1.67)	0.822
Relevance	33.96	36.94	1.14 (0.65–1.99)	0.647
Makes people think about the health effects of energy drinks	34.91	46.85	1.64 (0.95–2.84)	0.075
Discourages people from wanting to drink energy drinks	24.53	35.14	1.67 (0.92–3.01)	0.089
Overall rating of effectiveness	29.25	30.63	1.07 (0.60–1.91)	0.824

[a]Weight gain label condition is the reference category.

intentions and subsequent behaviour change in the context of anti-smoking interventions [27, 28]. The results of this study were partially consistent with these findings, as apart from the perception that the labels are 'easy to understand', there were weak to moderate associations between measures of perceived effectiveness and intentions to reduce ED consumption.

Participants' perceptions of the effectiveness of the graphic warning labels provided insight into how they would be received by consumers in terms of understandability and acceptability. Overall, the graphic warning labels depicting weight gain and cardiac effects were perceived similarly on most measures of perceived effectiveness. However, the cardiac effects label was perceived more highly on some measures of perceived effectiveness. A significantly larger portion of participants perceived the cardiac label as attention-grabbing than the weight gain label. Furthermore, there were non-significant trends (e.g., absolute differences and odds ratios) indicating cardiac labels may perform better than the weight label in making people stop and think, making people think about the health effects of EDs and discouraging consumption. The similar levels of perceived effectiveness may, in part, explain why the warning labels did not differentially motivate individuals to reduce ED consumption. Perceptions of the effectiveness of the labels in this study were partially consistent with a previous ED study involving text-only warning labels of similar health effects [21], which found that measures of perceived effectiveness were generally equivalent across label types. However, an exception in the prior study was that the cardiac text label was perceived as more believable and more relevant to the consumer than the obesity text label.

TABLE 5 | Summary of Kruskal–Wallis statistics comparing differences in intention scores according to label conditions among subgroups (n = 343).

| | Label conditions | | | Kruskal-Wallis | |
| | Control | Weight | Cardiac | | |
	Mean rank	Mean Rank	Mean Rank	χ^2	p
Gender[a]					
Males	92.48	91.19	83.75	0.947	0.623
Females	74.36	76.40	78.68	0.266	0.875
Age					
18–24	116.34	108.27	121.94	1.542	0.462
25–39	55.55	63.59	48.38	3.871	0.144
SES quintile[b]					
More disadvantaged	85.21	84.41	81.96	0.136	0.934
Less disadvantaged	84.75	88.44	86.39	0.156	0.925
Highest qualification[c]					
Secondary school or less	66.79	63.02	65.16	0.229	0.892
Some tertiary/Completed vocational training	83.97	87.74	85.42	0.164	0.921
Finished university (bachelor's degree or higher)	20.11	22.32	20.54	0.272	0.873
BMI					
Normal/Underweight	95.51	95.31	98.92	0.165	0.921
Overweight	76.83	77.68	73.61	0.250	0.883
Consumption frequency[d]					
Non-daily consumers	130.89	131.73	136.67	0.292	0.864
Daily consumers	40.88	41.13	36.72	0.630	0.730
Knowledge of health effects					
No	63.61	63.35	66.86	0.222	0.895
Yes	110.24	109.19	104.66	0.333	0.847

[a]3.8% of participants (control n = 5, weight = 4, cardiac = 4) identified as neither man nor woman, or did not declare their gender and are not included in this analysis.
[b]1.17% of participants (control n = 1, weight = 2, cardiac = 1) did not declare the postcode of their residences and are not included in this analysis.
[c]0.87% of participants (control n = 1, weight = 1, cardiac = 1) did not specify their highest qualification obtained and are not included in this analysis.
[d]Responses were dichotomised to form 'non-daily consumers' and 'daily consumers'.

It was promising that around 90% of participants exposed to either label agreed that they were easy to understand, with over half of the sample also perceiving the labels to be believable, and attention-grabbing. However, only around one-third perceived either label was relevant or taught them something. These results may indicate that the messages communicated by both labels did not resonate with many ED consumers. However, it is important to note that participants were exposed to warning labels briefly in an experimental setting, which is likely to be inadequate in producing real shifts in knowledge of health risks. As previously mentioned, interventions that incorporate a multifaceted approach that targets a number of domains (knowledge and awareness, behavioural and environmental), including repeated exposure to health messages through comprehensive social marketing campaigns, are required to provide a deeper understanding of the health effects and support healthier consumption habits. This study provides promising evidence for the potential of warning labels on EDs to encourage consumers to think about the health effects of consumption.

This study had several strengths. Firstly, the inclusion of a control group allowed for the comparison between experimental labels and no label. Inspection of data indicated that randomisation was successful with no significant differences in demographic characteristics between conditions. Additionally, measures of PMT constructs were adapted from existing studies [24, 34, 35]. Internal consistencies were excellent apart from the subscales for perceived severity, response costs and self-efficacy. Potential response biases were somewhat mitigated by the fact that the study was an online self-administered survey.

Conversely, this study was not without methodological limitations. A notable limitation of this study was the inclusion of only adult participants aged 18 to 39, while a considerable portion of ED consumers are adolescents [47]. This study also employed a convenience sample. Participants were recruited online using Facebook or through a university. The sample may not be nationally representative as online recruitment restricted this study to those who self-select to participate (self-selection bias). Nevertheless, the primary purpose of this study was to compare the relative effectiveness of different graphic warning labels and not to establish population parameters.

This study has several implications for the development of effective interventions to promote positive behaviour change regarding ED consumption. The results indicated that graphic warning labels depicting weight gain and cardiac effects did not differentially influence intentions to reduce ED consumption for the overall sample. Consistent with these findings, participants' perceptions of the effectiveness of the two labels were mostly similar. However, there were some indications (significant and non-significant trends [odds ratios and absolute differences]) that the cardiac effects label may be perceived more highly on some indicators of perceived effectiveness. It is likely the sample may have been underpowered to reliably detect some of the smaller effects. While participant's intentions to reduce ED consumption did not differ between the control (no label) and intervention groups, the study still provides some promising indications that labels can raise awareness of health effects and make people think about the health risks of consumption which are important antecedents for behavioural change. Findings of previous research suggest that health communication alone is not enough to produce actual behaviour change [48, 49]. Hence, a holistic approach incorporating interventions at many levels should be adopted [43, 50], one that encompasses policies and environmental modifications such as increasing health literacy and regulating the costs and availability of the products.

As discussed previously, the absence of an effect for graphic warning labels can be partially explained by ED consumers being different from consumers of other products, and FoP health messaging as an intervention on its own is not enough to motivate them to engage in positive behaviour change. This study briefly looked at the motivations for ED consumption. A future research direction is for qualitative studies to explore the drivers underlying ED consumption and the messages that might resonate with ED consumers. Further quantitative studies could benefit from a longitudinal design, as repeated exposures over an extended period of time in controlled experimental settings can give a more comprehensive idea of the impact of warning labels [42]. Future research should also examine the potential impact of graphic warning labels on ED consumption among adolescents, who make up a notable portion of ED consumers [47].

5 | Conclusion

The results from this randomised experimental online survey of Australian ED consumers indicated that, overall, graphic warning labels depicting weight gain and cardiac effects did not influence consumption intentions. There was, however, a significant gender difference for those who viewed the label depicting cardiac effects and perceptions of some perceived effectiveness measures were moderate to high. These results indicate that there is potential for FoP warning labels to reduce ED consumption, and it warrants further investigation.

Ethics Statement

Ethics approval was provided by the University of Adelaide School's Subcommittee for Human research in the School of Psychology. Participation in this study was entirely voluntary. Participants could withdraw for any reason at any time before the submission of the survey.

Conflicts of Interest

The authors declare no conflicts of interest.

Data Availability Statement

Research data are not shared.

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Supporting Information

Additional supporting information can be found online in the Supporting Information section.