





## RESEARCH ARTICLE

# A randomised experimental study comparing perceptions of two energy drink health warning labels

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## Abstract

**Issue addressed:** Consumption of energy drinks is a public health concern, particularly in adolescents and young adults. This study explored energy drink consumers' reactions to an energy drink-specific warning label (risk of cardiac effects) and a more general sugary drink warning label (risk of obesity).

**Methods:** An online experimental study randomly allocated Australian energy drink consumers aged 18-39 years ( $N = 435$ ) to view one of two label conditions (cardiac effects or obesity). Participants were assessed on: intention to reduce energy drink consumption, perceived health threat, perceived label effectiveness and policy support for energy drink warning labels.

**Results:** Mean intentions to reduce consumption scores were similar across the two label conditions ( $M_{obesity} = 2.5$ ,  $M_{cardiac} = 2.6$ ) overall; and were higher for the cardiac label (compared to obesity label) for some subgroups: females ( $M_{obesity} = 2.3$ ,  $M_{cardiac} = 2.8$ ;  $p = .037$ ), older (25-39 years;  $M_{obesity} = 2.4$ ,  $M_{cardiac} = 2.8$ ;  $p = .016$ ); and higher education level ( $M_{obesity} = 1.9$ ,  $M_{cardiac} = 2.7$ ;  $p = .004$ ). While perceived health threat measures were higher for obesity than cardiac effects, perceived label effectiveness measures of 'believable' and 'relevant to me' were higher for the cardiac label than the obesity label (believable: 71.0% vs 56.1%; relevant: 42.5% vs 29.4%). Participants who viewed the cardiac label were more likely to support policy than those shown the obesity label ( $OR = 1.6$ , 95%CI [1.1, 2.3],  $p = .02$ ).

**Conclusions:** Health effect warnings labels were perceived by energy drink consumers to be impactful and are supported. Labels with energy drink-specific health effects may offer additional benefit.

**So what?:** Policy makers can feel confident that warning labels on energy drinks will confer public health benefit.

## KEYWORDS

energy drinks, health star rating system, nutrition labelling, obesity, policy, sugary drink, warning labels

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## 1 | INTRODUCTION

Energy drinks (EDs) are a type of sugar-sweetened beverage (SSB) typically containing high levels of caffeine, sugar, B complex vitamins, amino acids, guarana and taurine. Like many other SSBs they are also available in 'lite', 'diet' or 'no sugar' versions. Marketed to improve energy, concentration, athletic performance and metabolism, EDs are the fastest-growing segment of the beverage market in Australia with global sales exceeding AUD\$30 billion.<sup>1</sup> Overconsumption of EDs is a growing public health problem and Australians are among the highest consumers of EDs worldwide, with those aged 18 to 24 years the highest consumers.<sup>2,3</sup>

There is increasing concern regarding the adverse health effects associated with ED consumption.<sup>4</sup> The Australian Dietary Guidelines recommend that ED consumption be limited due to lack of nutritional value, and increased risk of tooth decay, type 2 diabetes, weight gain and various cardiovascular complications associated with consumption, including increased heart rate, high blood pressure, arrhythmias, and in extreme cases, sudden cardiac death.<sup>5</sup> Excess consumption can also result in anxiety, headaches, sleep difficulties and nausea from caffeine toxicity.<sup>6</sup> These adverse effects are largely preventable by reducing ED consumption. Thus, interventions and policies to reduce ED consumption are essential.

While the sale of EDs in Australia is unrestricted, EDs have a maximum caffeine level of 320 mg/L and they must have an advisory statement on the package indicating (i) the recommended daily intake limit (500 ml), and (ii) EDs are not recommended for children, pregnant or lactating women, or caffeine-sensitive persons.<sup>7</sup> There are no regulations on the location, size and wording used for this statement. Subsequently, this statement has been described by consumers as poorly visible, confusing and encouraging excess consumption.<sup>8</sup> A recent cross-sectional study of 1,922 Australian ED consumers found that less than two-fifths were aware of the maximum daily intake guidelines.<sup>9</sup> Similarly, qualitative research with Australians aged 12-25 years identified low awareness of the advisory statement and poor knowledge of adverse health effects associated with ED consumption.<sup>10</sup> This research suggests there is a knowledge gap regarding daily intake of EDs and that current advisory statements on packaging are insufficient to adequately inform consumers.

Improved packaging and labelling are components of a suite of potential policy options to reduce overconsumption of unhealthy food and beverages, which also include public education, advertising restrictions and taxation.<sup>11</sup> Front-of-package (FOP) warning labels on food and beverage products can educate and assist consumers in making more nutritious choices, and subsequently prevent or reduce obesity and other diet-related chronic disease.<sup>12</sup> FOP nutrition labelling systems, such as Australia and New Zealand's Health Star Rating system, are widespread internationally, however, implementation of warning label systems are scarce. To date, mandatory 'high in sugar' warnings have been introduced in four countries (Chile in 2016; Peru in 2019; Israel and Uruguay in 2020) with Canada to follow in 2026.<sup>13,14</sup>

The potential effectiveness of on-product warning labels for SSBs to reduce SSB consumption and related outcomes (eg, purchasing behaviour, intentions to consume or purchase) have been shown by observational results from Chile (24% decline in 'high in' beverage purchases) and a number of experimental studies.<sup>15-21</sup> Evidence also

indicates that specific label content may be more motivating in encouraging behaviour change. A study of parents found warning labels that increased perceived risks of SSB consumption were more effective in discouraging choosing an SSB for their child, compared to calorie and nutrient labelling.<sup>22</sup> Similarly, another study found a diabetes health effects label was more effective in reducing purchase intentions of SSBs compared to an obesity health effects label.<sup>20</sup> Only one small US study of adolescents ( $n = 10$ ) and adults ( $n = 26$ ) has investigated the impact of ED-specific labelling on purchase intentions.<sup>23</sup> Both label conditions (caffeine content and possible adverse health effects, for example, headache, irregular heartbeat, and, in extreme cases, death) were more effective than the control in reducing ED purchases among adolescents, but not among adults in the sample.

Differences in health warning label effectiveness may be explained, in part, by differences in participants' perceptions of these health effects, for example, perceived threat – an important determinant of behaviour change as identified by the Health Belief Model.<sup>24,25</sup> Perceived health threat is comprised of perceived susceptibility and perceived severity of the health problem.<sup>26</sup> Perceived effectiveness of health campaigns and interventions are also a preliminary predictor of cognitive and behavioural change.<sup>27</sup> Perceived effectiveness of different ED health messages has not been compared, and this may have important implications for designing effective ED health warnings. Understanding individuals' perceptions of labels and different health effects displayed may explain whether they would be differentially motivated to reduce ED consumption. To date, it is not known whether an ED-specific health message (focused on stimulant health effects, eg, risk of cardiac effects) may be more effective in reducing consumption intentions than an SSB health message (eg, risk of obesity).<sup>18</sup>

Interest in warning labels on SSBs is growing among policy makers and the Australian community,<sup>28</sup> and in other countries.<sup>15-17,21</sup> While there is strong support among Australian adults for SSB warning labels as a policy initiative,<sup>28</sup> public support for ED-specific warning labels has not been assessed. ED consumption involves additional potential health risks due to added stimulants and caffeine, which may result in different perceptions towards initiatives to curb consumption. Policy makers would benefit from insight into levels of support for ED-specific policy initiatives.

This study was conducted to provide preliminary evidence on whether consumers respond differently to an ED-specific warning label than a general SSB warning label, among a sample of young adults, the most frequent ED consumers in Australia.<sup>3</sup> We tested whether an ED-specific warning label (risk of cardiac effects from stimulants and caffeine), resulted in greater intention to reduce consumption and perceived effectiveness, than a general SSB warning label (risk of obesity). Secondary aims of this study were to assess support for potential ED FOP warning label policy among ED consumers. Furthermore, identifying public knowledge of potential adverse health effects of ED consumption, attitudes towards policy and the characteristics of individuals who support policy or who may react differently to interventions, is beneficial in developing effective health messages to encourage evidence-based policy change.<sup>29</sup> Accordingly, we examined differences in intentions to reduce consumption between label conditions within demographic subgroups. We also explored whether level of support for labelling as a

policy intervention differed according to demographic characteristics, as well as by ED consumption, knowledge of ED health effects, awareness of current ED advisory statements (on product) and the label they viewed (cardiac or obesity).

## 2 | METHOD

Ethics was obtained from the University of Adelaide School of Psychology Human Research Ethics Subcommittee (reference 19/49).

### 2.1 | Participants

Participants were recruited using Facebook advertising and paper-based flyers at the University of Adelaide over a six-week period (May to July 2019). The Facebook advertisement invited Australian ED consumers aged 18 to 39 years to participate in a survey on attitudes, knowledge and behaviours regarding EDs. Eligibility included: Australian residency, aged 18 to 39 (most frequent ED consumers),<sup>3</sup> fluent in English, not working in the beverage industry, and had consumed at least one ED within the last 3 months. EDs were defined to potential participants as 'beverages that claim to enhance mental alertness and physical performance. They contain caffeine and other stimulants, eg, Red Bull, Monster, V, Mother and Rockstar. This does not include sports drinks such as Powerade or Gatorade'.<sup>30</sup> Non-consumers were not included as they are not the likely target of interventions reducing ED consumption. Participation was incentivised by the potential to win one of three \$100 Coles Myer gift vouchers.

### 2.2 | Study design

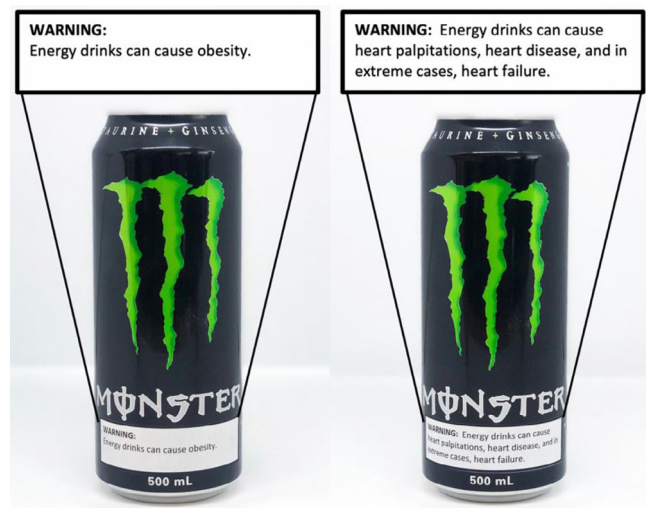
This online randomised trial was programmed using REDCap survey software. Participants were blindly and randomly allocated to one of two label conditions, cardiac or obesity, based on existing effective SSB FOP warning label literature (Figure 1).<sup>16,17,19</sup> All participants completed identical surveys with the exception of the label displayed. Surveys assessed ED consumption, knowledge of health risks and current advisory statements prior to viewing the warning label to prevent biasing of responses to these measures. After viewing their assigned label (cardiac or obesity), participants completed questions on perceived label effectiveness, behavioural intention to reduce consumption, perceived health threat, policy support and demographic characteristics.

### 2.3 | Measures

#### 2.3.1 | Baseline/pre-exposure to warning label

##### Consumption

ED consumption frequency was assessed by asking participants, 'How often do you consume any energy drinks?' with available responses



**FIGURE 1** The two ED labels as shown in each experimental condition

of: less than once a month, 1 to 3 times per month, once a week, more than once a week, or daily, based on previous measures.<sup>31</sup> Responses were recoded to 'Monthly or less', 'Weekly' and 'Daily'. To assess usual ED consumption quantity, participants were asked to report how many 250 ml or 500 ml cans (or total ml) they consume on an average day that they drink EDs by responding in one of three text boxes which enabled them to either report the number of 250 ml cans, the number of 500 ml cans or the total ml consumed. Responses were dichotomised according to whether they consumed over 500 ml per day (exceeded recommended daily limit) or not. Similar to alcohol, heavy ED consumption on an occasional basis, or binge drinking behaviour, is associated with increased health risk.<sup>32</sup> Therefore, participants were asked to report the most number of 250 ml or 500 ml cans (or total ml) they have consumed in 1 day using the same response format as for 'usual consumption'. Respondents' perceptions of their own consumption were also ascertained by asking whether they considered their average ED consumption to be 'just right', 'too much', 'not enough' or 'do not know', based on a similar SSB measure used with adolescents and adults.<sup>33</sup>

##### Knowledge

Participants rated, from a prompted list (presented in Table 2), the extent to which they believed potential health risks were associated with ED consumption on a 5-point Likert scale from 1 'Not at all' to 5 'A great deal', with a midpoint of 3 'Somewhat'.<sup>4</sup> For clarity in analysis, responses were dichotomised. Scores of three and above represented knowledge of health risk and scores of two and below represented lack of knowledge.<sup>19,21</sup>

Simple awareness of the current advisory statement on EDs was assessed through the question 'Are you aware of any warnings currently on energy drink cans?' with potential response options 'yes', 'no' and 'do not know'. Participants who answered 'yes' were then asked to recall the specifics of these statements, and if they were

unsure to write 'do not know'. Content analysis was conducted by the lead author (JC) to code the presence of correct key words in responses (includes partially correct responses) versus incorrect recall/unsure (Table 2).

### 2.3.2 | Post-exposure to warning label

#### *Perceived label effectiveness*

Six items assessed participants' perceived effectiveness of their assigned label, specifically; 'grabs my attention', 'is easy to understand', 'is believable', 'makes me stop and think', 'taught me something new' and 'is relevant to me'.<sup>34</sup> Participants were asked to indicate their agreement on a scale of 1 'strongly disagree' to 5 'strongly agree' with responses dichotomised to 'agree' (strongly or somewhat agree) or 'not agree' (neither, strongly or somewhat disagree) for analysis.

#### *Intentions to reduce energy drink consumption*

Based on previous measures,<sup>35,36</sup> participants were asked to rate the extent to which they were interested in, planned to, and were likely to reduce their ED consumption in the next month, on a scale of 1 'Not at all' to 5 'A great deal'. A mean intention score was calculated with higher scores indicating greater intention to limit consumption of EDs.

#### *Perceived health threat (susceptibility and severity of health effects)*

Perceived health threat of obesity and cardiac effects were assessed by the relevant susceptibility and severity subscales of the Health Belief Model Scale in Obesity,<sup>37</sup> and the Health Beliefs Related to Cardiovascular Disease Scale,<sup>38</sup> with wording adapted for use in the current study. All participants completed both obesity and cardiac effect measures regardless of the health warning they were exposed to. Participants indicated their agreement with each item on a scale of 1 'strongly disagree' to 5 'strongly agree'. For example, regarding obesity: 'There is a high risk of developing health problems due to obesity' (susceptibility), and 'Obesity is an important disease that leads to serious health effects' (severity); and for cardiac effects 'It is likely that I will suffer from heart palpitations or heart disease in the future' (susceptibility) and 'My whole life would change if I had heart palpitations or heart disease' (severity). As the number of items in the obesity and cardiac effects subscales differed (8 and 10, respectively), the scores were summed and then transformed to a 0 to 100 scale to enable comparison. Higher scores indicated that participants perceived that they are highly susceptible to the health effect/the health effect is severe.

#### *Policy support*

Participants were asked, 'Would you favour or oppose a government policy requiring the above warning label to be placed on energy drinks?' based on similar measures.<sup>16,17,22</sup> Responses were categorised as 'in favour' (strongly or somewhat), 'neither in favour or oppose', or 'oppose' (strongly or somewhat).

### 2.3.3 | Demographics

Demographics assessed were: age, gender, postcode, country of birth, highest qualification, employment, and height and weight to enable a calculation of body mass index (BMI). Postcodes enabled calculation of level of disadvantage scores according to the Australian Bureau of Statistics' Socio-Economic Indexes for Areas,<sup>39</sup> dichotomised as 'more disadvantaged' (deciles 1-5) and 'less disadvantaged' (deciles 6-10) categories for ease of interpretation during analysis. Postcode also enabled determination of remoteness according to the Australian Statistical Geography Standard Remoteness Structure,<sup>40</sup> with 'metropolitan' (major cities) or 'regional/remote' (inner and outer regional, remote and very remote Australia) categorisation.

### 2.3.4 | Analyses

Statistical analyses were conducted in SPSS version 25. A Type I error rate of .05 was adopted. A Welch independent samples *t*-test was used to test for differences in mean consumption intentions between experimental groups. A series of chi-square tests of independence were used to determine whether participant characteristics were equivalent across label conditions, and to explore whether perceived label effectiveness and support for policy differed by warning label type and other sociodemographic variables. To identify differences in intentions within consumer demographics, exploratory analyses were conducted using *t*-tests. Cumulative odds ordinal logistic regression analyses were conducted to identify characteristics associated with support for ED warning label policy.

## 3 | RESULTS

Of the 435 participants who completed the survey, 49.2% ( $n = 214$ ) were randomly allocated to the obesity label and 50.8% ( $n = 221$ ) to the cardiac effects label. The sample was 54.3% ( $n = 236$ ) male, 52.4% ( $n = 228$ ) were aged 18 to 24 years, 42.7% ( $n = 183$ ) were from more disadvantaged SES areas (deciles 1-5), 89.2% ( $n = 388$ ) were born in Australia, 50.0% ( $n = 212$ ) had a BMI in the normal range, 65.1% ( $n = 283$ ) were employed, 23.3% ( $n = 101$ ) had a bachelor degree or higher and 53.9% ( $n = 234$ ) had completed some tertiary/vocational training. A series of chi-square analyses indicated there were no significant differences in participant characteristics between the two label conditions, providing evidence of successful randomisation (Table 1).

Consumption of EDs varied in this sample, with 37.5% consuming monthly, 35.4% consuming weekly and 27.1% consuming daily. Over one quarter of participants reported that on an average day they exceed the recommended daily ED consumption limit (>500 ml) and 84.1% have previously exceeded the recommended limit on 1 day, with 20% of all participants reporting consumption of 10 or more

**TABLE 1** Participant characteristics for the total sample, and by experimental condition (N = 435)

Variable	Label type				Total		$\chi^2$
	Cardiac		Obesity		no.	%	
	no.	%	no.	%	no.	%	
Gender <sup>a,b</sup>							
Male	119	53.8	117	54.7	236	54.3	0.136
Female	97	43.9	87	40.7	184	42.3	$p = .713$
Age group <sup>b</sup>							
18-24	119	53.8	109	50.9	228	52.4	0.262
25-39	102	46.2	105	49.1	207	47.6	$p = .609$
Socioeconomic position <sup>b</sup>							
More disadvantaged	92	42.4	91	42.9	183	42.7	0.00
Less disadvantaged	125	57.6	121	57.1	246	57.3	$p = .990$
Remoteness <sup>b</sup>							
Metropolitan	164	75.2	164	77.4	328	76.3	0.164
Regional/remote	54	24.8	48	22.6	102	23.7	$p = .685$
Country of birth <sup>b</sup>							
Australia	199	90.0	189	88.3	388	89.2	0.181
Other	22	10.0	25	11.7	47	10.8	$p = .670$
BMI <sup>b</sup>							
Normal/underweight	101	47.4	111	52.6	212	50.00	0.943
Overweight/obese	112	52.6	100	47.4	212	50.00	$p = .285$
Highest qualification							
Some tertiary/completed vocational training	121	55.3	113	52.8	234	54.0	0.864
Finished university (bachelor degree or higher)	47	21.5	54	25.2	101	23.3	$p = .649$
Secondary school or less	51	23.3	47	22.0	98	22.6	
Employment <sup>b</sup>							
Employed full or part time	141	63.8	142	66.4	283	65.1	0.210
Student/not employed <sup>c</sup>	80	36.2	72	33.6	152	34.9	$p = .647$
Consumption frequency							
Monthly or less	84	38.0	79	36.9	163	37.5	5.536
Weekly	68	30.8	86	40.2	154	35.4	$p = .063$
Daily	69	31.2	49	22.9	118	27.1	
Exceed daily limit on average days <sup>b</sup>							
No $\leq$ 500 ml per day	149	69.3	158	75.2	307	72.2	1.582
Yes >500 ml per day	66	30.7	52	24.8	118	27.8	$p = .208$
Exceed daily limit in past <sup>b</sup>							
No $\leq$ 500 ml per day	35	15.8	34	16.0	69	15.9	.000
Yes >500 ml per day	186	84.2	179	84.0	364	84.1	$p = 1.00$
Perception of own consumption							
Just right	82	37.1	97	45.3	179	41.1	3.168
Too much	114	51.6	94	43.9	208	47.8	$p = .366$
Not enough	4	1.8	4	1.9	8	1.8	
Do not know	21	9.8	19	8.9	40	9.2	

<sup>a</sup>3.4% of participants (cardiac n = 5, obesity n = 10) did not declare their gender, and are not included in this comparison.

<sup>b</sup>Yates' Correction for Continuity used to compensate for the overestimate of chi-square when a 2 × 2 table.

<sup>c</sup>11.3% of participants (cardiac n = 23, obesity n = 11) not employed.

**TABLE 2** Baseline knowledge of health risks associated with ED consumption, and awareness of current advisory statements (N = 435)

N = 435	No.	%
Baseline knowledge of health effects <sup>a</sup>		
Tooth decay	406	93.3
Heart or cardiovascular complications/ disease	378	86.9
Type 2 diabetes	372	85.5
High blood pressure (hypertension)	370	85.1
Weight gain	360	82.8
Anxiety	320	73.6
Depression	194	44.6
Cancer	173	39.8
Baseline awareness of current advisory statement		
Yes	308	70.8
No	80	18.4
Do not know	47	10.8
Advisory statement recall (of those who were aware) <sup>b</sup> n = 308		
<i>Correct recall of advisory statement content (total)</i>		
Daily limit	281	91.2
Not recommended for pregnant or lactating women	224	51.5
Not recommended for children	182	41.8
Not recommended for individuals sensitive to caffeine	54	12.4
Contains caffeine	45	10.3
Consume responsibly	28	6.4
Consume responsibly	2	0.5
<i>Incorrect recall of advisory statement content (total)</i>		
Heart effects	27	8.8
Do not know	39	9.0
Other <sup>c</sup>	18	4.1
Do not consume with alcohol	12	2.8
	9	2.1

<sup>a</sup>Participants could select multiple items from a list.

<sup>b</sup>Only participants who were aware of a warning statement on ED cans (n = 308, 70.8%) were asked to recall the statement.

<sup>c</sup>Other responses included anxiety, asthma, may affect medications, high sugar content, contains artificial sweeteners.

250 ml ED cans on 1 day. Almost half of all participants (47.8%) perceived their average weekly ED consumption to be 'too much', while 41.1% perceived that it was 'just right', 1.8% reported 'not enough' and 9.2% were unsure.

As can be seen from Table 2, baseline knowledge of health risks associated with ED consumption was high at over 80% for most of the assessed health effects. Over 90% of participants were aware there was an advisory statement on ED packaging, with a very high proportion able to freely recall at least one element of this advisory statement.

### 3.1 | Perceived effectiveness of warning labels

A significantly greater proportion of participants indicated the cardiac label was 'believable' and 'relevant to me' as compared to the obesity label (Table 3). Participants' perceptions of the other label effectiveness indicators were equivalent for obesity and cardiac label types.

### 3.2 | Effects of warning label type on intentions to reduce energy drink consumption

Overall, participants reported moderate levels of intentions to reduce ED consumption ( $M = 2.6, SD = 1.3$ ). There were no significant difference in intention to reduce ED consumption scores for those who viewed the cardiac label ( $M = 2.6, SD = 1.3$ ) and the obesity label ( $M = 2.5, SD = 1.3; t(435) = 1.3, p = .20$ ; Cohen's  $d = 0.12, 95\% CI [-0.1, 1.9]$ ).

#### 3.2.1 | Exploratory subgroup analyses

Exploratory analyses were conducted to examine differences in mean intention score between the label types among different population subgroups. As presented in Table 4, females, participants aged 25 to 39, and those with a bachelor's degree or higher had significantly higher intentions to reduce consumption when exposed to the cardiac label compared to participants exposed to the obesity label. Intention to reduce consumption did not significantly differ by any other participant characteristics.

### 3.3 | Perceived health threat

Participants perceived that they were more susceptible to obesity than adverse cardiac effects ( $M_{obesity} = 56.2, M_{cardiac} = 45.8, p < .001, 95\% CI [8.0, 12.9]$ , Cohen's  $d = 0.39$ ), and they perceived obesity as the health outcome with more severe consequences ( $M_{obesity} = 79.0, M_{cardiac} = 42.3, p < .001, 95\% CI [34.7, 38.8]$ , Cohen's  $d = 1.66$ ). Perceived susceptibility and perceived severity for both health outcomes did not vary significantly by label condition.

### 3.4 | Support for potential energy drink front-of-pack warning label policy

Overall, 49.7% of the sample were strongly/somewhat in favour of policy to put the health warning label they had been shown (during the experiment) on EDs, 31.3% indicated they were neither in favour or opposed the policy, and 19.1% strongly/somewhat opposed.

#### 3.4.1 | Predictors of support for policy

At the bivariate level, policy support significantly differed according to experimental condition (label type), gender, ED consumption



frequency, knowledge of depression and anxiety as potential health effects associated with ED consumption, awareness of current ED advisory statement, and ability to correctly recall part of the current ED advisory statement. Participants who were shown the cardiac label were more likely to be in favour (55.7%) than those shown the obesity label (43.7%),  $\chi^2(2) = 6.5, p = .039$ . Females showed a greater support

for policy (55.4%) than males (46.6%),  $\chi^2(2) = 7.9, p = .019$ . Less frequent ED consumers were more in favour than daily consumers (monthly: 60.1%, weekly: 47.4%, daily: 38.1%),  $\chi^2(4) = 20.6, p < .001$ . Participants with greater knowledge of depression (56.2% vs 44.4%) and anxiety (53.8% vs 38.3%) as potential health effects associated with ED consumption were more in favour of policy (depression:

**TABLE 3** Perceptions of label effectiveness according to label type viewed (N = 435)

Perceived label effectiveness	Label type		$\chi^2$	<i>p</i>	Phi
	Cardiac %	Obesity %			
Grabs my attention					
Agree	63.3	58.4	0.92	0.339	-0.05
Not agree	36.7	41.6			
Is easy to understand					
Agree	95.5	92.5	1.20	0.273	-0.06
Not agree	4.5	7.5			
Is believable					
Agree	71.0	56.1	9.89	0.002	-0.16
Not agree	29.0	43.9			
Makes me stop and think					
Agree	37.6	31.8	1.36	0.244	-0.06
Not agree	62.4	68.2			
Taught me something new					
Agree	17.6	18.2	0.001	0.975	0.01
Not agree	82.4	81.8			
Is relevant to me					
Agree	42.5	29.4	7.53	0.006	-0.14
Not agree	57.5	70.6			

Note: All expected cell frequencies were greater than five. Yates' Correction for Continuity was used to compensate for the overestimate of chi-square.

**TABLE 4** Intentions to reduce energy drink consumption within demographic subgroups by label type (N = 435)

Intentions to reduce ED consumption	Label type		<i>t</i>	<i>p</i>	<i>d</i>
	Cardiac (n = 221) M (SD)	Obesity (n = 214) M (SD)			
Gender <sup>a</sup>					
Male	2.5 (1.2)	2.6 (1.3)	-0.27	.789	0.03
Female	2.7 (1.4)	2.3 (1.2)	2.10	.037	0.31
Age					
18-24	2.5 (1.3)	2.6 (1.3)	-0.46	.649	0.06
25-39	2.8 (1.3)	2.4 (1.2)	2.42	.016	0.34
Highest qualification <sup>b</sup>					
Finished high school	2.4 (1.3)	2.6 (1.3)	-0.94	.349	0.19
Some tertiary education	2.7 (1.3)	2.7 (1.2)	0.27	.791	0.03
Completed university (bachelor degree or higher)	2.7 (1.4)	1.9 (1.1)	2.94	.004 <sup>c</sup>	0.59

<sup>a</sup>3.4% of participants (cardiac n = 5, obesity n = 10) did not declare their gender, and are not included in this comparison.

<sup>b</sup>n = 2 participants (cardiac condition) prefer not to say.

<sup>c</sup>Equal variances not assumed due to unequal sample sizes.

$\chi^2(2) = 6.0, p = .049$ , anxiety:  $\chi^2(2) = 10.8, p = .005$ ). Awareness of the current ED advisory statement was significantly associated with greater policy support (59.8% vs 45.5%),  $\chi^2(2) = 9.2, p = .01$ . Similarly, the ability to correctly recall part of the current ED advisory statement was significantly associated with greater policy support (59.1% vs 44.5%),  $\chi^2(2) = 11.4, p = .003$ . Policy support did not significantly differ by any other participant characteristics.

Variables significant at the bivariate level were included in the multivariable analysis. The warning label shown to participants significantly impacted their support for FOP ED health warning label policy. Participants who were shown the cardiac label had significantly greater odds ( $OR = 1.6, 95\% CI [1.1, 2.3]$ ) of being strongly/somewhat in favour of the policy than those shown the obesity label,  $\chi^2(1) = 5.4, p = .02$ . Knowledge of anxiety as a potential health effect associated with ED consumption was also a significant predictor of policy support ( $OR = 1.7, 95\% CI [1.1, 2.7]$ ),  $\chi^2(1) = 4.8, p = .028$ . No other variables contributed significantly to the model.

## 4 | DISCUSSION

Health warning labels are a promising policy option to reduce energy drink (ED) consumption, and the presence of a warning label has been shown to reduce sugar-sweetened beverage (SSB) consumption and related outcomes.<sup>15-17,19,21</sup> This was a novel study to experimentally determine whether highlighting the specific health effects of EDs (cardiac effects) have potential to reduce consumption, beyond communicating SSB general health effects on EDs (obesity). Overall, the cardiac effects label was not found to have a greater impact on consumption intentions. However, there was a difference observed in perceptions of threat: participants perceived themselves as more susceptible to obesity and it was perceived as more severe than cardiac health effects. These results were in contrast to findings from previous SSB studies that suggest different health messages may differentially impact consumption intentions,<sup>20,22,41</sup> and that obesity is typically perceived as a lesser health risk than other conditions, such as diabetes.<sup>20,41</sup> However, these SSB studies did not assess heart health effects, and were conducted on SSB consumers. ED consumers may self-exempt from heart health messages because past ED consumption has not resulted in instant cardiac symptoms. In contrast, obesity occurs over time and is not immediately evident, and body image issues are also more prevalent in young adults (the primary ED consumers) who may perceive obesity as a particularly negative consequence.<sup>42</sup> ED consumers of this study may also have a greater awareness of the health risk of obesity (as opposed to cardiac health effects) due to campaigns that have been conducted in Australia, which may have increased perceptions of severity.<sup>43</sup> More research is required into the characteristics of young adults who consume EDs and how they may differ from SSB consumers.

When analysed separately, intention to reduce ED consumption were higher for the cardiac label among females, older participants (25-39 years), and those with higher levels of education. This finding is consistent with previous research that females and older participants

are more likely to engage in health promoting behaviours for cardiovascular disease.<sup>44</sup> However, Temple et al.<sup>23</sup> Found that the ED health warning label conveying caffeine health effects was effective in reducing adolescents' selection of EDs, but not adults. They concluded that the adverse health effects of excess caffeine consumption were more novel to adolescents and thus more likely to impact their behaviour. This effect may not have been found in our sample as we did not include adolescents.

Measures of perceived effectiveness of warning labels were generally equivalent across label types, which may explain why the warning labels did not differentially motivate individuals to reduce ED consumption. While the majority of participants agreed that both of the labels grabbed their attention and were easy to understand, smaller proportions (less than 40%) reported that the labels made them 'stop and think', or taught them 'something new'. Existing high levels of knowledge of adverse health effects associated with frequent ED consumption may explain these responses, as over 80% reported cardiovascular effects and weight effects as consequences of ED consumption. An exception was that the cardiac label was perceived as more believable and more relevant to the consumer than the obesity label. Although these associations were small, the percentage differences between the conditions are notable after a very brief exposure to the label.

While perceptions of relevance and believability were higher for the cardiac label, participants of this study rated obesity more highly in severity and susceptibility than cardiac effects. Other research conducted in Canada has found cardiovascular symptoms were more frequently identified as an adverse health concern of ED consumption than weight gain.<sup>45</sup> There may be some disconnect between how participants view the overall threat of a health condition, and how they perceive the effectiveness of a label communicating the health effect, which is worthy of consideration in future research. The potential label effectiveness for either health effect should not be underestimated given participants had only one exposure to the information, and such initiatives are normally part of a multi-faceted intervention involving mass media campaigns, labelling or taxes.<sup>46</sup>

Policy makers require insight into community perceptions of potential policy initiatives, in addition to evidence of effectiveness.<sup>47</sup> Approximately half of all study participants, who were ED consumers, supported potential front-of-package (FOP) warning label policy for EDs. This is consistent with previous studies that indicate lower levels of support among consumers in various health settings.<sup>28,48</sup> However, having a visual representation of the product with a label could also result in even lower levels of policy support compared to studies that have assessed support for a generic statement pertaining to text warning labels.<sup>28</sup> ED consumers are also likely to differ to SSB consumers in many respects (demographic profile, consumption habits and drivers of consumption), which may also explain ED consumers' lower receptiveness to policy intervention.

There was little variation in policy support according to knowledge of health effects in this study. This contrasts with previous SSB research that indicates individuals with greater knowledge of SSB health risks were more likely to support policy.<sup>28</sup> This is likely explained



by the high level of pre-existing knowledge of potential health risks associated with ED consumption in this sample. However, participants who reported anxiety as a potential health effect of ED consumption had greater policy support. Policy support was also greater among participants who viewed the cardiac label compared to the obesity label. The obesity label may be perceived as unintentionally stigmatising overweight individuals as found in other studies.<sup>49</sup> In contrast, the cardiac label may be perceived as more acceptable, consistent with the greater perceptions of relevance and believability also found for the cardiac label in this sample. Replacing the term 'obesity' with 'weight gain' may overcome this potential stigmatisation and increase support for this label type without impacting label effectiveness, as previous research found that there were no differences in parents perceptions of the health risks of SSBs or in hypothetical SSB selection for their child between SSB FOP warning labels depicting either obesity or weight gain.<sup>17</sup>

#### 4.1 | Strengths and limitations

Experimental online studies with a sample of convenience are commonly used to provide preliminary evidence of the potential effectiveness of a new intervention.<sup>16,19</sup> However, they have lower ecological validity than a population survey, and results are not generalisable to the broader population. This study was focussed on ED consumers as they most impacted by ED-warning labels, and inclusion of non-consumers was a limitation of a previous ED labelling study.<sup>23</sup> However, warning labels may prevent non-consumers from trying EDs and future studies should include a subsample of non-consumers.

Self-report measures pose risk of social desirability bias. However, notable strengths of this study include anonymous online completion, the blind randomisation of participants to each experimental condition, and participants were not aware that we were testing two different warning labels. Any response bias that may have occurred would be equivalent across experimental conditions and not impact comparisons between warning label types.

The incorporation of a control group was out of scope for this study; however, future research including a larger representative sample and a control group is planned to strengthen these findings and provide further evidence for the effectiveness of incorporating labels on SSBs and EDs. Like many studies conducted to provide preliminary evidence to inform interventions,<sup>16,19</sup> the main outcome of this study was self-reported intention to reduce ED consumption as a precursor to behaviour change. It is unclear whether intentions would translate to real world behaviour change. As this was one of the first studies to compare different health effect messages on EDs, it provides important preliminary insight into the comparative effect of the labels.

## 5 | CONCLUSION

This study is the first to examine the relative effectiveness of a cardiac ED-specific warning label and an obesity general SSB health effect warning label on intention to reduce ED consumption. While overall,

neither the obesity or cardiac FOP warning label was more effective or ineffective than the other in reducing intention to consume EDs, the results provide preliminary evidence of the differential impact of health messages on different consumer subgroups and show moderate support for potential FOP ED warning label policy among ED consumers. Therefore, it is important to consider the potential impact of different health warnings in changing attitudes and behaviour, especially when implemented within a multifaceted approach combining several coordinated interventions that reinforce and support behavioural change such as, sustained exposure to health messages via campaigns, labelling or taxes.

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#### CONFLICT OF INTEREST

The authors declare no conflict of interest.

#### DATA AVAILABILITY STATEMENT

The data presented in this study are available on request from the corresponding author. The data are not publicly available due to ethical and privacy restrictions.

#### ETHICS STATEMENT

Ethics approval was obtained from the University of Adelaide School of Psychology Human Research Ethics Subcommittee (reference 19/49). Informed consent was obtained from all participants prior to participation in the study.

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#### REFERENCES

1. Heckman MA, Sherry K, De Meija EG. Energy drinks: An assessment of their market size, consumer demographics, ingredient profile, functionality, and regulations in the United States. *Comprehens Rev Food Sci Food Saf.* 2010;9(3):303–17.
2. De Sanctis V, Soliman N, Soliman AT, Elsedfy H, Di Maio S, El Kholy M, et al. Caffeinated energy drink consumption among adolescents and potential health consequences associated with their use: A significant public health hazard. *Acta Biomed.* 2017;88(2):222–31.
3. Pennay A, Cheetham A, Droste N, Miller P, Lloyd B, Pennay D, et al. An examination of the prevalence, consumer profiles, and patterns of energy drink use, with and without alcohol, in Australia. *Alcohol Clin Exp Res.* 2015;39(8):1485–92.

4. Ali F, Rehman H, Babayan Z, Stapleton D, Joshi DD. Energy drinks and their adverse health effects: A systematic review of the current evidence. *Postgrad Med.* 2015;127(3):308–22.
5. Higgins JP, Babu K, Deuster PA, Shearer J. Energy drinks: A contemporary issues paper. *Curr Sports Med Rep.* 2018;17(2):65–72.
6. Al-Shaar L, Vercammen K, Lu C, Richardson S, Tamez M, Mattei J. Health effects and public health concerns of energy drink consumption in the United States: A mini-review. *Front Public Health.* 2017; 5:225.
7. Food Regulation Standing Committee Caffeine Working Group. Food regulation policy options paper: The regulation of caffeine in foods. Sydney, Australia: Australian Government Department of Health; 2013.
8. Costa BM, Hayley A, Miller P. Young adolescents' perceptions, patterns, and contexts of energy drink use: A focus group study. *Appetite.* 2014;80(1):183–9.
9. Peacock A, Droste N, Pennay A, Miller P, Lubman DI, Bruno R. Awareness of energy drink intake guidelines and associated consumption practices: A cross-sectional study. *BMC Public Health.* 2016;16(1):6.
10. Francis J, Martin K, Costa B, Christian H, Kaur S, Harray A, et al. Informing intervention strategies to reduce energy drink consumption in young people: Findings from qualitative research. *J Nutr Educ Behav.* 2017;49(9):724–33.e1.
11. Köhler K, Eksin M, Peil E, Sammel A, Uuetoa M, Villa I. Policy brief: Reducing the consumption of sugar-sweetened beverages in Estonia (World Health Organization EVIPNet initiative). World Health Organization Regional Office for Europe: Copenhagen, Denmark; 2016.
12. Institute of Medicine [US] Committee on Examination of Front-of-Package Nutrition Rating Systems and Symbols. Front-of-package nutrition rating systems and symbols: Phase 1 report. Washington, DC: National Academic Press (US); 2010.
13. Kanter R, Vanderlee L, Vandevijvere S. Front-of-package nutrition labelling policy: Global progress and future directions. *Public Health Nutr.* 2018;21(8):1399–408.
14. Israel Ministry of Health. Food label and nutrition labeling 2019. Available from: [https://www.health.gov.il/English/Topics/FoodAndNutrition/Nutrition/Adequate\\_nutrition/Pages/labeling.aspx](https://www.health.gov.il/English/Topics/FoodAndNutrition/Nutrition/Adequate_nutrition/Pages/labeling.aspx).
15. Taillie LS, Reyes M, Colchero MA, Popkin B, Corvalán C. An evaluation of Chile's law of food labeling and advertising on sugar-sweetened beverage purchases from 2015 to 2017: A before-and-after study. *PLoS Med.* 2020;17(2):e1003015.
16. Donnelly GE, Zatz LY, Svirsky D, John LK. The effect of graphic warnings on sugary-drink purchasing. *Psychol Sci.* 2018;29(8):1321–33.
17. VanEpps EM, Roberto CA. The influence of sugar-sweetened beverage warnings: A randomized trial of adolescents' choices and beliefs. *Am J Prev Med.* 2016;51(5):664–72.
18. Bollard T, Maubach N, Walker N, Ni Mhurchu C. Effects of plain packaging, warning labels, and taxes on young people's predicted sugar-sweetened beverage preferences: An experimental study. *Int J Behav Nutr Phys Activity.* 2016;13(1):95.
19. Billich N, Blake MR, Backholer K, Cobcroft M, Li V, Peeters A. The effect of sugar-sweetened beverage front-of-pack labels on drink selection, health knowledge and awareness: An online randomised controlled trial. *Appetite.* 2018;128:233–41.
20. Gray JP, Karnon J, Blackwell L. Sugar consumption from beverages and the potential effects of a text-based information label. *Aust N Z J Public Health.* 2011;35(1):88–9.
21. Roberto CA, Wong D, Musicus A, Hammond D. The influence of sugar-sweetened beverage health warning labels on parents' choices. *Pediatrics.* 2016;137(2):e20153185.
22. Mantzari E, Vasiljevic M, Turney I, Pilling M, Marteau T. Impact of warning labels on sugar-sweetened beverages on parental selection: An online experimental study. *Prev Med Rep.* 2018;12: 259–67.
23. Temple JL, Ziegler AM, Epstein LH. Influence of price and labeling on energy drink purchasing in an experimental convenience store. *J Nutr Educ Behav.* 2016;48(1):54–9.e1.
24. Janz NK, Becker MH. The health belief model: A decade later. *Health Educ Q.* 1984;11(1):1–47.
25. Rosenstock IM. Historical origins of the health belief model. *Health Educ Monogr.* 1974;2(4):328–35.
26. Glanz K, Rimer BK, Viswanath K. Health behavior and health education: Theory, research, and practice. 4th ed. San Francisco: John Wiley & Sons; 2008.
27. Davis K, Nonnemaker J, Duke J, Farrelly M. Perceived effectiveness of cessation advertisements: The importance of audience reactions and practical implications for media campaign planning. *Health Commun.* 2013;28(5):461–72.
28. Miller C, Dono J, Wakefield M, Pettigrew S, Coveney J, Roder D, et al. Are Australians ready for warning labels, marketing bans and sugary drink taxes? Two cross-sectional surveys measuring support for policy responses to sugar-sweetened beverages. *BMJ Open.* 2019;9(6):e027962.
29. Niederdeppe J, Heley K, Barry CL. Inoculation and narrative strategies in competitive framing of three health policy issues. *J Commun.* 2015;65(5):838–62.
30. Galemore CA. Sports drinks and energy drinks for children and adolescents—Are they appropriate? A summary of the clinical report. *NASN Sch Nurse.* 2011;26(5):320–1.
31. Hedrick VE, Savla J, Comber DL, Flack KD, Estabrooks PA, Nsiahkumi PA, et al. Development of a brief questionnaire to assess habitual beverage intake (BEVQ-15): Sugar-sweetened beverages and total beverage energy intake. *J Acad Nutr Diet.* 2012;112(6):840–9.
32. Breda JJ, Whiting SH, Encarnação R, Norberg S, Jones R, Reinap M, et al. Energy drink consumption in Europe: A review of the risks, adverse health effects, and policy options to respond. *Front Public Health.* 2014;2:134.
33. French S, Rosenberg M, Wood L, Maitland C, Shilton T, Pratt IS, et al. Soft drink consumption patterns among Western Australians. *J Nutr Educ Behav.* 2013;45(6):525–32.
34. Scully M, Morley B, Wakefield M, Dixon H. Can point-of-sale nutrition information and health warnings encourage reduced preference for sugary drinks? An experimental study. *Appetite.* 2020;149:104612.
35. Klein WM, Zajac LE, Monin MM. Worry as a moderator of the association between risk perceptions and quitting intentions in young adult and adult smokers. *Ann Behav Med.* 2009;38(3):256–61.
36. Grummon AH, Hall MG, Taillie LS, Brewer NT. How should sugar-sweetened beverage health warnings be designed? *Prev Med.* 2019; 121:158–66.
37. Ozden D, Cicek F. Development and evaluation of the health belief model scale in obesity. *TAF Prev Med Bull.* 2011;10(5):533–42.
38. Tovar EG, Rayens MK, Clark M, Nguyen H. Development and psychometric testing of the health beliefs related to cardiovascular disease scale: Preliminary findings. *J Adv Nurs.* 2010;66(12):2772–84.
39. Australian Bureau of Statistics. Census of population and housing: Socio-economic indexes for areas (SEIFA), Australia, 2016. 2018. Contract No.: 2033.0.55.001.
40. Australian Bureau of Statistics. Australian Statistical Geography Standard (ASGS): Volume 5 – Remoteness Structure, July 2016. 2018. Contract No.: 1270.0.55.005.
41. Miller C, Ettridge K, Dono J, Wakefield M, Pettigrew S, Coveney J, et al. Young adults' reactions to warning labels on the bottles of sugary drinks. Melbourne, Australia: The Australian and New Zealand Obesity Society; 2018.
42. Wardle J, Haase AM, Steptoe A. Body image and weight control in young adults: International comparisons in university students from 22 countries. *Int J Obes (Lond).* 2006;30(4):644–51.
43. Kite J, Grunseit A, Bohn-Goldbaum E, Bellew B, Carroll T, Bauman A. A systematic search and review of adult-targeted overweight and

- obesity prevention mass media campaigns and their evaluation: 2000–2017. *J Health Commun.* 2018;23(2):207–32.
44. Deeks A, Lombard C, Michelmore J, Teede H. The effects of gender and age on health related behaviors. *BMC Public Health.* 2009; 9(1):213.
45. McCrory C, White CM, Bowman C, Fenton N, Reid JL, Hammond D. Perceptions and knowledge of caffeinated energy drinks: Results of focus groups with Canadian youth. *J Nutr Educ Behav.* 2017;49(4): 304–11.e6.
46. Hill D, Wakefield M. Designing and evaluating population-wide campaigns. *World cancer report.* 2014;201.
47. Morrato EH, Elias M, Gericke CA. Using population-based routine data for evidence-based health policy decisions: Lessons from three examples of setting and evaluating national health policy in Australia, the UK and the USA. *J Public Health.* 2007;29(4): 463–71.
48. Miller C, Wakefield M, Kriven S, Hyland A. The air we breathe: Evaluation of smoke-free dining in South Australia: Support and compliance among the community and restaurateurs. *Aust N Z J Public Health.* 2002;26(1):38–44.
49. Puhl R, Peterson JL, Luedicke J. Fighting obesity or obese persons? Public perceptions of obesity-related health messages. *Int J Obes (Lond).* 2013;37(6):774–82.

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