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Sugar consumption from high sugar beverages, and the potential effects of a text-based information label in an Australian population: postal survey

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Abstract

Objective: To provide evidence on the effects of two front-of-pack text-based information labels on purchasing of high sugar beverages. Labels advise of increased risk of obesity or diabetes associated with high sugar beverage consumption.

Methods: A postal survey was developed to obtain information on current household beverage purchases, understanding of the proposed information labels, and stated changes in purchasing resulting from the application of the labels.

Results: 130 completed surveys were returned (response rate 66%). In a typical week, 79.2% of households purchased at least one of five high sugar beverages. In purchasing households, estimated sugar intake from high sugar beverages alone ranged from 12.3g to 2307.2g per person per week (equivalent to 30 to 5603kJ per day), with a median intake of 185.1g (450kJ per day). 41.7% (95%CI 25.5 to 59.2) of diabetes label respondents and 35.3% (95%CI 22.4 to 49.9) of obesity label respondents stated they would reduce purchasing of at least one labelled high sugar beverage.

Conclusion and Implications: Provides preliminary evidence that front-of-pack text-based information labels advising consumers of health risk may be a potentially effective way to reduce purchasing and consumption of high sugar beverages.

Key words: food labelling, soft drink, sweetened drink, obesity, diabetes

Introduction

The 2004-05 National Health Survey found half of Australian adults and thirty percent of Australian children and adolescents are overweight or obese.[1] Beverages which contain large quantities of sugars are of particular concern in promoting weight gain and type 2 diabetes.[2-6] These beverages, such as soft drinks, fruit drinks, fruit juices and cordials, have been implicated as a substantial source of sugar in the diets of Australian children and adults.[7-9] Consumption of high sugar beverages has been shown to increase total energy intake due to little or no reduction in the energy intake at subsequent meals to offset the energy in the beverage.[3, 5] Studies also suggest that sugar sweetened beverages increase energy intake from other sources, possibly by acting as appetite stimulant or satiety suppressor.[5] Decreasing consumption of sugar-sweetened beverages has been shown to slow weight gain and reduce overweight and obesity in adolescents and children, particularly those with higher baseline BMI's.[4, 10-11]

Labelling foods with health and nutrition information has been shown to be an effective way to influence consumer perception and to promote behaviour change towards more healthful choices.[12-14] However, consumer difficulty with understanding and interpreting the health and nutrition information provided on food labels is a key concern raised in the Issues Consultation Paper of the Council of Australian Governments (COAG) Food Labelling Law and Policy Review.[15] The Review is currently occurring within Australia and New Zealand and aims to report findings in late 2010.

A review of the literature around supply side strategies to address obesity and overweight identified food and nutrition labelling as a key issue, particularly front-of-pack labelling systems.[16-19] However, little research around the use of text-based information labels was retrieved, with only one such study identified. This study used text-based warning labels to advise consumers of chronic disease risk from food products[12] and suggested text-based labels have the potential to influence consumer behaviour.

We hypothesized that text-based front of pack labels advising individuals of the increased health risks associated with consumption of high sugar beverages would lead to a decrease in purchasing (and therefore consumption) of these beverages. To this end, we developed two front-of-pack text-based information labels to be placed on high sugar beverages. The aim of the study was to describe current purchasing patterns for non-alcoholic beverages, and elicit stated changes in beverage purchasing in response to the labels.

Methods

Label design

To assess the role of high sugar beverages in the development of obesity and overweight, a PubMed search was conducted during January 2009. The search strategy "(sweetened drink* OR soft drink*) AND (weight gain OR obesity OR overweight OR diabetes mellitus)" located 284 articles, of which 54 were review articles. Relevant articles were identified on the basis of title and then abstract. Further articles were located via citations within relevant articles.

A variety of potential label messages were discussed, ranging from a straight statement indicating a good/bad beverage, a general risk statement or a quantified risk statement. The decision to use general risk messages enabled labels to be placed on beverages strongly believed to contribute to obesity/overweight and diabetes but where insufficient research exists to ascertain specific risk (e.g. cordial).

Evidence to support the label "Drinking this drink may increase your risk of obesity" was derived from multiple studies,[2, 4, 10-11, 20-21] a systematic review,[3] two reviews[22-23] and a meta-analysis.[5] The survey used in the current study stated that this label was to be placed on sugar-sweetened soft drinks, fruit juices, fruit drinks and cordials.

No relevant meta analyses were identified to support the label "Drinking sugar sweetened drinks may increase your risk of diabetes", however three large observational studies with follow-up periods of between 8 and 12 years found the risk of diabetes increased with higher consumption of sugar sweetened soft drinks and fruit drinks.[4, 24-25] The diabetes label was to be placed on sugar-sweetened soft drinks, fruit drinks and cordials (but not fruit juices).

Survey design

In order to target the purchasing patterns of households, rather than individuals, the survey was directed to the person in the household most responsible for grocery shopping. To inform the choice of non-alcoholic beverages to include in the survey document, a review of beverages on supermarket shelves was conducted during February 2009. From this review we developed a comprehensive list of beverage categories (soft drinks, fruit juices, fruit drinks, vegetable juices, sports drinks, energy drinks, cordials, iced teas, bottled water and milk drinks), beverage varieties (e.g. regular, reduced sugar, diet, sugar free), sugar content (in g/100ml) and container sizes.

The survey was piloted with eight academic colleagues, experienced in survey design and implementation. After amendments based upon their recommendations, the revised survey was piloted with a cohort of non-academic friends and acquaintances to obtain naïve feedback. Following this stage, the survey was again amended to enhance participant

understanding and ease of completion. These changes resulted in the final survey documents (see www.adelaide.edu.au/pcsip/drinks).

Two final versions of the survey were produced, which differed only with respect to the label presented (i.e. the obesity or diabetes label). Current beverage purchasing patterns were assessed by asking "In a typical week, would you buy the following drinks? If yes, please enter how many of each size container you purchase." The question listed 11 beverages (sorted by beverage category and variety), with yes/no tick boxes. Next to the yes response, 3 container sizes were listed – small bottle or can (less than 1 litre), medium bottle (1 litre to less than 2 litres), or large bottle (more than 2 litres). An example was provided to assist respondents. Participants then viewed the information label and, using a four point Likert scale ("agree," "neither agree nor disagree," "disagree," or "don't know"), were asked to state the extent to which they agreed with the following statements: "I understand this label", "Sweetened drinks are bad for you", Drinking sweetened drinks can cause diabetes" (or "obesity" in obesity version), and "This information is new to me."

The survey indicated the diabetes label would be placed on regular carbonated soft drink, fruit drink (less than 50% fruit juice) and regular cordial, while the obesity label would be placed on regular carbonated soft drink, 100% fruit juice, fruit drink and regular cordial. No label was to be placed on flavoured milk. The following section asked how the label might change purchasing patterns using the question "For all the drink categories below, please select your likely response if the information was placed on selected drinks." The same list of 11 beverages was given, with a clear marking to indicate the beverages on which the information label would be placed. Participants answered using a five point Likert scale with options of "would not buy," "decrease," "buy the same," "increase" or "don't know."

The study was approved by the Human Research Ethics Committee of the University of Adelaide (reference number: H-155-2009). Participant consent was implied by return of a completed survey.

Sampling

Sample size for the survey was estimated using the following primary measure of outcome: the proportion of respondents stating an intended decrease in purchasing of at least one beverage displaying an information label. Specifying a 90% confidence level, an estimated 25% of respondents indicating they would decrease purchasing, and a desired confidence interval of ±10%, gave a minimum sample size of 51. Expecting a response rate of approximately 50%, this gave a required sample of 100 for each label group.

A sample of 400 households were randomly selected from the residential section of the White Pages, Adelaide 2008-09,[26] excluding incomplete addresses (i.e. without house numbers). One name from the same position on every second page was selected until 400 households (names and addresses) were obtained. As obesity and overweight,[27-28] high sugar drink

consumption[29-30] and low usage of NIP's[31-33] are more common in lower SES groups we targeted our sample towards lower SES areas. The 400 households were sorted by SES of suburb, using the SEIFA Index of Relative Socio-Economic Advantage/Disadvantage 2006 developed by the Australian Bureau of Statistics.[34] The 200 households with the lowest SES were selected and given an identification number. Odd numbered households were sent the obesity label survey and even numbered households sent the diabetes label survey.

The survey was distributed in March 2009. To maximise response rates the survey protocol utilised a pre-letter and two follow up letters.[35] The pre-letter was received 3 days before the survey, the survey itself was sent with a cover letter, pre-paid envelope and a University pen as a token of appreciation. A follow up postcard, thanking those who had returned their surveys and asking those who had not to please do so soon, was sent a week later. A replacement survey with a new cover letter was sent three weeks after the first survey. Thirteen surveys were returned as undeliverable. Of these, ten were returned early enough to be replaced with the next household on the list. Replacement households did not receive the pre-letter due to time constraints.

Statistical analysis

The primary analysis concerned the percentage of respondents reporting an intended decrease in the purchasing of labelled drinks. Sub-analyses looked at differences across drink categories with respect to current purchasing levels, sugar intake, and stated changes in purchasing. The direct responses to the labels' information content were also analysed. Binomial proportion confidence intervals and proportional p values were estimated for stated changes in purchasing and response to the labels respectively.

Volume estimations for each purchased beverage were calculated using the following: a small bottle/can equal to 375mL, medium bottle equal to 1 litre, and a large bottle equal to 2 litres. To estimate the sugar content for each type of beverage, we surveyed supermarket shelves for a range of products from each beverage type and calculated the average sugar content from the per 100mL values on the label. Sugar content for cordial was calculated as per the dilution instructions on the label (i.e. 1 part cordial to 4 parts water). Energy content was calculated as grams of sugar multiplied by the number of kilojoules per gram (17kJ) and divided by 7 to obtain daily intake values. Estimates of individual consumption and sugar intake assumed all members of the household consume the purchased beverages in equal quantities. Analysis was conducted using SPSS (PASW Statistics 17.0.2) and STATA 10 (StataCorp LP).

Results

Of the 197 letters delivered, 15 were returned blank (7.6%) and 130 were completed, giving a response rate of 66.0%. Respondent characteristics are presented in Table 1, which shows that 72.3% were Australian born and 63.8% lived in a household without children. With the survey being directed to the person in the household who does most of the grocery shopping, the majority of respondents were female (80.0%). The only noticeable difference between the obesity and diabetes returns was that the diabetes group contained a larger percentage of smokers (19.4%, compared with 7.4% in the obesity group).

The distribution of respondents across the SES quintiles was very similar to the distribution across the 210 households included in the initial mail-out. The two versions of the survey (obesity or diabetes label) were returned in approximately equal numbers (52.3% of completed surveys contained the obesity label).

Current Beverage Purchasing

79.2% of households purchased at least one of the five high sugar beverages listed in the survey (regular carbonated soft drink, 100% fruit juice, fruit drink, regular cordial and flavoured milk) in a typical week (Table 2). In these households the mean number of high sugar beverage types purchased was 2.0 (SD 1.1). Of the high sugar beverages, fruit juice (60.0%) and regular soft drink (40.0%) were the most commonly purchased. When purchased, regular soft drink was the high sugar beverage purchased in the largest quantity, with a median volume of 1.3 litres per person in household. 33.8% of households purchased diet soft drink.

Regular and reduced sugar cordials contributed the most to sugar intake per person per week in purchasing households (median weekly intake: regular 233.9g, reduced sugar 175.0g). Regular carbonated soft drink (143.7g) and fruit drink (105.8g) also contributed large amounts to sugar intake.

In households that purchased high sugar beverages, sugar intake from high sugar beverages alone ranged from 12.3g to 2307.2g per person per week, with a median intake of 185.1g, equivalent to 69.0% of sugar intake from all beverages. Based on sugar intake, energy intake from high sugar beverages in these households ranged from 30 to 5603kJ per person per day, with a median intake of 450kJ per person per day.

A small number of households purchased very high volumes of specific high sugar beverages. For example, three households purchased between 8 to 12L of regular carbonated soft drink per person per week and two households purchased 6.7 or 8L of flavoured milk per person per week.

Response to the Label

The majority of participants agreed that they understood the label (92.9%, 95% CI 86.9 to 96.7), that these drinks were bad for you (72.3%, 95% CI 63.3 to 80.1) and that these drinks can cause obesity/diabetes (depending on the label viewed; 70.9%, 95% CI 61.8 to 79.0). Most participants disagreed that the information on the label was new to them (62.2% 95% CI 51.9 to 71.8).

Participant responses to the label were analysed by the type of label shown (obesity or diabetes) and whether the respondent purchased any of the five high sugar beverages (Table 3). Of those who purchased any of the five high sugar beverages, 13.6% of those viewing the diabetes label disagreed that these beverages can cause diabetes while only 2.0% of those who viewed the obesity label disagreed that these beverages can cause obesity (p=0.03). This was the only significance difference found between the groups.

Change in Purchasing Due to Label

Table 4 shows that, for those respondents currently purchasing some form of high sugar beverage, 35.3% of those receiving the obesity label stated they would reduce purchasing of at least one of the four labelled high sugar beverages (95% CI 22.4 to 49.9). For the diabetes label, 41.7% (95% CI 25.5 to 59.2) stated they would reduce purchasing of at least one of the three labelled high sugar beverages.

For the obesity label, intended reductions were stated by 44.4% (95% CI 13.7 to 78.8) of those currently purchasing fruit drink, 31.6% (95% CI 12.6 to 56.6) of those purchasing regular soft drink, 22.7% (95% CI 11.5 to 37.8) of those currently purchasing 100% fruit juice and 18.8% of those currently purchasing regular cordial (95% CI 4.0 to 45.6).

The diabetes label affected a statistically significant stated reduction in the purchase of regular carbonated soft drink (41.4%, 95% CI 23.5 to 61.1) and regular cordial (35.3%, 95% CI 14.2 to 61.7). Even though fruit juice and flavoured milk were not labelled in this version of the survey, 11.1% (95% CI 2.4 to 29.2) of respondents who purchased fruit juice and 42.9% (95% CI 9.9 to 81.6) of respondents who purchased flavoured milk indicated they would reduce or cease to buy these beverages.

Of the 103 participants (3 missing) who purchased one or more high sugar beverages, 36.0% (95% CI 26.6 to 46.2) would reduce purchasing of one or more and 13.0% (95% CI 7.1 to 21.2) would reduce purchasing of all currently purchased high sugar beverages. Of the 58 participants who purchased two or more high sugar beverages, 43.1% (95% CI 30.2 to 56.8) would reduce purchasing of one or more, 12.1% (95% CI 5.0 to 23.3) would reduce purchasing of two or more, and 3.4% (95% CI 0.4 to 11.9) would reduce purchasing of all currently purchased high sugar beverages.

A small percentage of respondents (16.7%, 95% CI 4.7 to 37.4) would substitute the diet version of a beverage for the regular (i.e. decrease regular purchasing and increase purchasing of the diet version).

Table 1: Demographic characteristics of participants

	All (n=130)		Obesity (n=68)		Diabetes (n= 62)	
	N°	%	N°	%	N°	%
Sex						
Male	23	17.7	8	11.8	15	24.2
Female	104	80.0	57	83.8	47	75.8
Missing	3	2.3	3	4.4	0	0.0
Age (years)						
25 - 34	9	6.9	6	8.8	3	4.8
35 - 44	32	24.6	17	25.0	15	24.2
45 - 54	33	25.4	16	23.5	17	27.4
55 - 64	21	16.2	12	17.6	9	14.5
65 or over	34	26.2	17	25.0	17	27.4
Missing	1	0.8	0	0.0	1	1.6
Education Level						
Year 10 or under	43	33.1	21	30.9	22	35.5
Year 11 or 12	38	29.2	19	27.9	19	30.6
University or Other Tertiary	43	33.1	26	38.2	17	27.4
Missing	6	4.6	2	2.9	4	6.5
SES Quintile [a]						
1 (most disad.)[b]	27	20.8	12	17.6	15	24.2
2	16	12.3	10	14.7	6	9.7
3	37	28.5	22	32.4	15	24.2
4	43	33.1	21	30.9	22	35.5
5 (least disad.)[c]	6	4.6	2	2.9	4	6.5
Missing	1	0.8	1	1.5	0	0.0
Country of Birth						
Australian	94	72.3	50	73.5	44	71.0
Other	35	26.9	17	25.0	18	29.0
Missing	1	0.8	1	1.5	0	0.0
Total in Household						
Mean (SD)	2.5 (1.2)		2.6 (1.2)		2.5 (1.3)	
Missing	5	3.8	3	4.4	2	3.2
Household Composition						
No children	83	63.8	43	63.2	40	64.5
Children (under 18 years)	41	31.5	22	32.4	19	30.6
If children, mean (SD)	1.8 (0.8)		1.8 (0.8)		1.8 (0.8)	
Missing	6	4.6	3	4.4	3	4.8

Walking (hours per week)						
Less than 1	24	18.5	14	20.6	10	16.1
1 to less than 2	28	21.5	14	20.6	14	22.6
2 to less than 4	32	24.6	13	19.1	19	30.6
4 to less than 6	22	16.9	13	19.1	9	14.5
More than 6	21	16.2	13	19.1	8	12.9
Missing	3	2.3	1	1.5	2	3.2
Physical activity [d] (hours per week)						
Less than 1	45	34.6	24	35.3	21	33.9
1 to less than 2	30	23.1	17	25.0	13	21.0
2 to less than 4	28	21.5	14	20.6	14	22.6
4 to less than 6	16	12.3	9	13.2	7	11.3
More than 6	7	5.4	3	4.4	4	6.5
Missing	4	3.1	1	1.5	3	4.8
Smoking Status						
Smoker	17	13.1	5	7.4	12	19.4
Non-smoker	111	85.4	62	91.2	49	79.0
Missing	2	1.5	1	1.5	1	1.6
Read NIP [e]						
Always, Usually	59	45.4	31	45.6	28	45.2
Sometimes	39	30.0	20	29.4	19	30.6
Rarely, Never	30	23.1	16	23.5	14	22.6
Missing	2	1.5	1	1.5	1	1.6
Understand NIP [e]						
All of it, Most of it	75	57.7	38	55.9	37	59.7
Some of it	40	30.8	20	29.4	20	32.3
Hardly any of it, None of it	14	10.8	9	13.2	5	8.1
Missing	1	0.8	1	1.5	0	0.0

[a] Calculated as Quintile of Socio-Economic Advantage/Disadvantage by Postcode. [b] Most disadvantaged, least advantaged. [c] Least disadvantaged, most advantaged. [d] Physical activity described as any activity that "makes you breathe harder than normal" [e] Back-of-pack Nutrition Information Panel (NIP).

Table 2: Current beverage consumption in a typical week

Beverage Type	Number purchasing (%)	Volume Purchased Per Person in Household (litres)[a]				Sugar Intake Per Person in Household (grams)[a]					Energy Intake Per Person in Household (kilojoules) PER DAY [ab]			
	(n = 130)	Mean (SD)	Median	Min	Max	Sugar Content (g/100mL)	Mean (SD)	Median	Min	Max	Mean (SD)	Median	Min	Max
Plain Milk	121 (93.1)	1.7 (1.2)	1.3	0.2	6.0	5.0	84.7 (58.1)	66.4	9.3	298.8	206 (141)	161	23	726
100% Fruit Juice	78 (60.0)	0.9 (0.5)	0.7	0.1	2.7	9.8	84.6 (52.0)	69.4	12.3	261.3	205 (126)	169	30	635
Carbonated Soft Drink Regular	52 (40.0)	2.2 (2.6)	1.3	0.1	12.0	10.8	240.9 (280.4)	143.7	6.7	1293.6	585 (681)	349	16	3142
Carbonated Soft Drink Diet or No Sugar	44 (33.8)	1.6 (1.5)	1.0	0.1	6.8	0.0	0.0 (0.0)	0.0	0.0	0.0	0 (0)	0	0	0
Cordial Regular	36 (27.7)	0.7 (0.5)	0.6	0.0	2.0	40.1 (8.0 diluted)	262.9 (210.8)	233.9	12.5	802.0	639 (512)	568	30	1948
Bottled Water (Pure or Spring)	34 (26.2)	1.1 (1.4)	0.7	0.1	6.0	0.0	0.0 (0.0)	0.0	0.0	0.0	0 (0)	0	0	0
Flavoured Milk	22 (16.9)	1.3 (2.1)	0.5	0.2	8.0	9.6	120.8 (203.6)	47.8	17.9	764.8	293 (494)	116	44	1857
Cordial Diet or No Added Sugar	18 (13.8)	0.6 (0.6)	0.5	0.1	2.0	2.2 (0.44 diluted)	14.2 (13.5)	9.9	1.4	44.0	35 (33)	24	3	107
Fruit Drink (Less than 50% fruit juice)	17 (13.1)	1.0 (0.7)	1.0	0.2	2.5	10.6	110.6 (74.2)	105.8	19.8	264.5	269 (180)	257	48	642
Cordial Reduced Sugar	3 (2.3)	1.3 (0.6)	1.0	1.0	2.0	17.5 (3.5 diluted)	233.3 (101.0)	175.0	175.0	350.0	567 (245)	425	425	850
Flavoured Milk No Added Sugar	3 (2.3)	0.9 (0.7)	0.9	0.2	1.5	5.0	42.7 (32.8)	43.8	9.4	75.0	104 (80)	106	23	182
All Beverages	127 (97.7)	4.6 (3.3)	3.8	0.5	17.0	---	346.3 (361.1)	247.2	12.3	2357.0	841 (877)	600	30	5724
All Beverages, High Sugar Households Only [c]	103 (79.2)	4.9 (3.3)	4.1	0.5	17.0	---	396.4 (375.7)	268.3	12.3	2357.0	963 (913)	652	30	5724
All High Sugar Beverages [d]	103 (79.2)	2.4 (2.8)	1.4	0.1	16.0	---	313.6 (371.1)	185.1	12.3	2307.2	762 (901)	450	30	5603

[a] Calculations included only those households which purchased the beverage (not all respondents). Per person quantities were calculated as household volume (or sugar intake) divided by total number of people in household. Households were excluded from calculations if missing volume or household data. [b] Energy intake was calculated as per person sugar intake (grams) multiplied by number of kilojoules per gram of sugar (17kJ) and divided by 7 to give a daily value. [c] Calculations include only those households in which one or more of the 5 high sugar beverages (listed in d) were purchased. [d] The high sugar beverages are regular carbonated soft drink, 100% fruit juice, fruit drink (<50% juice), regular cordial or flavoured milk.

Table 3: Response to label

	I understand this label % Agree (p value)		Sweetened drinks are bad for you % Agree (p value)		Drinking sweetened drinks can cause obesity/diabetes [c] % Disagree (p value)		This information is new to me % Disagree (p value)	
Obesity								
Purchasers [a]	92.3		69.4		2.0		68.2	
Non-purchasers [b]	85.7	(0.45)	70.0	(0.97)	8.3	(0.27)	50.0	(0.32)
Diabetes								
Purchasers [a]	95.8		70.8		13.6		59.5	
Non-purchasers [b]	91.7	(0.55)	91.7	(0.14)	16.7	(0.79)	55.6	(0.83)
Purchasers [a]								
Obesity	92.3		69.4		2.0		68.2	
Diabetes	95.8	(0.46)	70.8	(0.88)	13.6	(0.03)	59.5	(0.41)

Obesity purchasers n=53, Obesity non-purchasers n=15, Diabetes purchasers n=50, Diabetes non-purchasers n=12. [a] Participants purchase one or more of the 5 high sugar drinks (regular carbonated soft drink, 100% fruit juice, fruit drink (<50% juice), regular cordial or flavoured milk) . [b] Participants don't purchase any of the 5 high sugar drinks (listed in a). [c] Question asked "can cause obesity" on obesity version of survey and "can cause diabetes" on diabetes version of survey

Table 4: Stated change in purchasing for high sugar beverages currently purchased

Beverage Type	% who would not buy (95% CI)			% who would not buy or would reduce volume purchased (95% CI)		
	Both	Obesity	Diabetes	Both	Obesity	Diabetes
Carbonated Soft Drink Regular [ab]	20.8 (10.5 - 35.0)	10.5 (1.3 - 33.1)	27.6 (12.7 - 47.2)	37.5 (24.0 - 52.6)	31.6 (12.6 - 56.6)	41.4 (23.5 - 61.1)
100% Fruit Juice [a]	2.8 (0.3 - 9.8)	2.3 (0.1 - 12.0)	3.7 (0.1 - 19.0)	18.3 (10.1 - 29.3)	22.7 (11.5 - 37.8)	11.1 (2.4 - 29.2)
Fruit Drink (Less than 50% fruit juice) [ab]	15.4 (1.9 - 45.4)	22.2 (2.8 - 60.0)	0.0 (0.0 - 60.2) [d]	30.8 (9.1 - 61.4)	44.4 (13.7 - 78.8)	0.0 (0.0 - 60.2) [d]
Cordial Regular [ab]	6.1 (0.7 - 20.2)	0.0 (0.0 - 20.6) [d]	11.8 (1.5 - 36.4)	27.3 (13.3 - 45.5)	18.8 (4.0 - 45.6)	35.3 (14.2 - 61.7)
Flavoured Milk [c]	5.6 (0.1 - 27.3)	0.0 (0.0 - 28.5) [d]	14.3 (0.4 - 57.9)	16.7 (3.6 - 41.4)	0.0 (0.0 - 28.5) [d]	42.9 (9.9 - 81.6)
At least 1 of the 5 High Sugar Beverages [e]	14.0 (7.9 - 22.4)	7.7 (2.1 - 18.5)	20.8 (10.5 - 35.0)	36.0 (26.6 - 46.2)	34.6 (22.0 - 49.1)	37.5 (24.0 - 52.6)
At least 1 of the 4 High Sugar Beverages with Obesity Label [f]	14.1 (8.0 - 22.6)	7.8 (2.2 - 18.9)	20.8 (10.5 - 35.0)	35.4 (26.0 - 45.6)	35.3 (22.4 - 49.9)	35.4 (22.2 - 50.5)
At least 1 of the 3 High Sugar Beverages with Diabetes Label [g]	18.8 (10.1 - 30.5)	10.7 (2.3 - 28.1)	25.0 (12.1 - 42.2)	39.1 (27.1 - 52.1)	35.7 (18.6 - 55.9)	41.7 (25.5 to 59.2)

[a] Obesity label in obesity version of survey. [b] Diabetes label in diabetes version of survey. [c] No label in either version of survey. [d] One-sided, 97.5% confidence interval.
[e] Regular carbonated soft drink, 100% fruit juice, fruit drink (<50% juice), regular cordial and flavoured milk. [f] Regular carbonated soft drink, 100% fruit juice, fruit drink (<50% juice) and regular cordial. [g] Regular carbonated soft drink, fruit drink (<50% juice) and regular cordial

Discussion

Although it is acknowledged that obesity is a multi-factorial and complex problem,[23] there is strong evidence that consumption of high sugar beverages increases the risk of becoming overweight or obese and contributes to the development of diabetes.[3, 5-6]

The current study estimated that in households that consume high sugar beverages, energy intake from all purchased high sugar beverages ranged from 0.3 to 64.4% of the 8700kJ recommended as the average daily value for adults,[36] with a median intake of 5.2% and an average of 8.8% (SD 10.4). Australian Dietary Guidelines[37] recommend that sugars make up no more than 15-20% of the total energy intake for adults. Based on recommended total energy intake (8700kJ) and equal consumption within households, people in 10.7% (95% CI 5.2 to 16.1) of all responding households exceeded the 20% recommendation based on high sugar beverage consumption alone. If using the more stringent WHO recommendation,[38] 21.3% (95% CI 14.0 to 28.6) of all participating households exceeded the recommended 10% level based on high sugar beverage consumption alone.

Using the 1995 National Nutrition Survey, Rangan *et al.*[7-8] found that 'extra' beverages (energy dense, nutrient poor beverages such as sugar sweetened soft drink, cordial, fruit drink and alcoholic drinks) contributed 9.0% of the total reported energy in the diets of Australian adults and 7.8% of the total reported energy in the diets of Australian children (aged 2 to 18 years). Our findings and those of Rangan *et al.* indicate that high sugar beverages make a significant contribution to the energy intake of some Australians.

If all regular soft drink, cordial and flavoured milk purchased by households participating in the current study was exchanged for diet versions, median sugar consumption from these beverages would reduce to 80.0g per person per week (194kJ per person per day) - a reduction of 56.8%. If these households also diluted all fruit juice and fruit drink by half (by adding water), median sugar consumption from these previously "high sugar" beverages would be reduced to 47.3g per person per week (115kJ per day) - a reduction of 74.4%.

The Food Labelling Law and Policy Review,[15] initiated by COAG, is currently reviewing the evidence on food labelling in Australia and New Zealand. In consultation with interested parties, the Review has queried whether food labelling should be used to support health promotion initiatives and whether warnings should be placed on food labels indicating health risk (e.g. high saturated fat per serve) and the related health consequences.

Key concerns raised by the Review include consumer difficulty with understanding and interpreting information on both the back (NIP) and front (health claims and %DI guides) of food packaging. Back-of-pack nutrition information panels (NIP) which are currently mandatory within Australia and New Zealand,[39] are considered too complex for many consumers to interpret. While many self-report using and understanding back-of-pack NIPs, observational studies during grocery shopping and objective measures of label

comprehension indicate poor comprehension and interpretation of labels, suggesting consumers may look at the NIP without processing its contents.[31] Consumers particularly struggle with technical terms, mathematical calculations (such as converting per 100g measures to serving sizes), serving sizes, comparisons between products (particularly if considering multiple nutrients) and understanding the role of each nutrient in a balanced diet.[31-33, 40] While these difficulties are most pronounced in individuals with lower levels of literacy and numeracy, even those with higher levels of education may experience difficulty.[32] Individuals with lower income and education levels, older age or from ethnic minorities are least likely to use and understand the NIP.[33, 40]

The current study provides preliminary evidence that a front-of-pack text-based information label advising consumers of the health risks associated with high sugar beverages, is a potentially effective way to reduce purchasing of these beverages. It is interesting to note that some participants appear to have extrapolated the warning from the labelled high sugar beverages to other high sugar beverages. This suggests that the label may have prompted a re-consideration of all beverage consumption and its contributory role to obesity and diabetes.

The effectiveness of the label is consistent with Bushman[12] who found warning labels on Philadelphia cream cheese led participants to choose to taste lower fat versions. Bushman suggests this indicates that warning labels may be highly effective, especially in environments where alternative choices are easy to access, equivalent in cost and provide a similar level of consumer satisfaction. However, although some consumers in the current study indicated they would replace the regular version with the diet version of a particular beverage, others indicated that this was not a satisfactory option. One of the themes that emerged in the comments section of the survey was consumer uncertainty around the health and safety of diet drinks and artificial sweeteners. This is a potentially important issue, as while non-caloric sweeteners are considered safe, there is still no evidence available on the long term effects in humans.[41]

Limitations and future directions

The main limitation of the current study is that participants report intended reductions in the purchase of high sugar beverages, reductions are not observed. Further evidence of observed actions may be required before enacting legislation that enforces the placement of such labels on soft drinks, but the current study illustrates the potential effects of such a strategy.

Issues around the study design include the possibility that the process of listing purchase quantities and answering questions relating to participants' comprehension and agreement with the labels may have influenced stated intentions, but as a pilot study we felt it was important to elicit participant perceptions of the information labels. The information label was also presented in isolation, and so the misrepresentation of information overload may be an issue. Such overload occurs when too many products display warning labels, leading to consumers becoming less attentive to warning messages.[42]

The use of a control group, representing purchasing intentions in the absence of an introduced text-based information label, was considered. However, we concluded that a survey that elicited current purchasing quantities, followed by questions relating to planned purchasing with no intervening action, would appear illogical and result in a biased response pattern.

Alternative survey techniques, such as face-to-face or telephone interviews, may have facilitated a more in-depth analysis of the issues raised, but a postal survey was selected as promoting more honest responses from participants through anonymity, as well as providing a cost-efficient method of obtaining the required sample.

Despite the limitations of the reported study, the statistically significant intended reductions in purchasing provide a basis for further research to substantiate the results. Moreover, the current study focussed on drinks purchases in the context of grocery shopping, and so does not cover all potential purchasing contexts. It is possible that reduced grocery-based purchasing may be compensated by increased consumption in other contexts, such as other household members increasing their personal purchasing of such products. However, it is also possible that such labels might also lead to reduced purchasing in these other contexts.

Further research could involve the development of labels to be attached to currently available drinks containers. Interested retailers could be randomised to sell drinks with and without the developed labels attached to their produce. If recruitment is slow, government controlled outlets (such as kiosks in leisure centres) could be randomised.

Conclusions and Implications

Preliminary evidence suggests that front-of-pack text-based information labels may be effective in reducing the purchase and consumption of high sugar non-alcoholic drinks.

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