

# Carbonated beverages consumption among New Zealand youth and associations with BMI and waist circumference

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## ABSTRACT

**Aim:** The primary aim of this study was to describe the carbonated beverage (soft drink) consumption patterns of New Zealand (NZ) youth and to investigate the influence that home availability of soft drinks had on their consumption. A secondary aim was to determine if there was an association between soft drink consumption and body mass index (BMI) or waist circumference.

**Methods:** Data from Youth'07, a nationally representative survey of the health and well-being of NZ youth, including 8,697 NZ students aged 13 to 17 years, were analysed.

**Results:** The relevant data was available for 8697 students of whom 4633 identified as NZ European, 1621 Māori, 1,098 Asian, 834 Pacific, and 504 Other. Twenty nine percent (29%) were categorised as high consumers of soft drinks ( $\geq 4$  times a week), 45.4% were moderate consumers (1-3 times a week), and 25.6% were low consumers (had not consumed soft drinks in the past week). Male gender, Pacific ethnicity, and high deprivation were all significantly associated with being in the high consumer group. Fifty eight percent (58%) of children who reported that soft drinks were 'usually' available at home were in the high consumption group, compared to 15.1% of children who reported that these drinks were never available at home. After adjusting for possible confounders, waist circumference was significantly associated with soft drink consumption ( $p < 0.05$ ), however, BMI was not. Mean soft drink consumption for boys was 3.5 times per week and was 2.0 for girls.

**Conclusion:** This study provides detailed information on soft drink consumption patterns of NZ youth and highlights factors associated with high consumption. Moderating the availability of soft drinks in the home is likely to significantly reduce their consumption among NZ youth.

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## Introduction

Sugar sweetened beverages (SSB), which are mainly consumed as carbonated beverages (commonly referred to as soft drinks or fizzy drinks) are associated with unhealthy weight gain, diabetes, cardiovascular disease and its risk factors, gout, and poor oral health.<sup>1-8</sup> Internationally, a variety of strategies have been introduced to reduce SSB consumption, often targeted at children and adolescents. These strategies range from soft drink taxes, policies and regulation that prevent the sale of SSBs in schools, hospitals, prisons or other state owned facilities, social marketing initiatives, and school based interventional packages.<sup>9-12</sup>

New Zealanders consume more sugar per capita than any other country in the OECD, and globally NZ was the 9th highest consumer of sugar in 2006.<sup>13, 14</sup> The American Heart Association recommend a daily sugar allowance of 9 teaspoons for men, 6 teaspoons for women and 3 teaspoons for children, the most recent nutritional surveys show that the average NZ man, woman and child consume 30, 24 and 26-33 teaspoons of sugar per day, respectively.<sup>15-17</sup> Sugar sweetened beverages are the leading single food item that contribute added sugar in the diet of NZ children and adults, making them an obvious candidate for interventions to reduce sugar consumption.<sup>16, 17</sup>

Few studies have described soft drink consumption patterns of NZ children. The 2002 National Nutrition Survey, found that over 60% of NZ Children consumed more than 1 Fruit drink or soft drink per day and that consumption was higher in Pacific (70%) and Māori (63%) compared to NZ European others (51%).<sup>17</sup> This Survey also found that SSBs were the leading contributor of sugar to children's diet.<sup>17</sup> The Obesity Prevention In Communities (OPIC) study, assessed fruit drink and soft drink consumption in high school students from NZ, Fiji, Tonga and Australia between 2005-2009. Overall NZ students had higher combined consumption than any of these countries. Approximately 30% of NZ students consumed soft drinks on 4 or 5 of the previous five school days.<sup>18</sup>

To help inform an evidence based public health response, to this problem, an understanding of current population consumption patterns of soft drinks is needed. The main purpose of this paper was to describe soft drink consumption patterns of NZ youth using data from the Youth 2007 national survey.<sup>19</sup>

## Methods

Data for the current study was collected as part of Youth'07, a national survey of the health and wellbeing of NZ secondary school students (approximate ages 13-17 years). Full details of the methodology and survey design of the Youth'07 survey are described elsewhere.<sup>20</sup> The Youth'07 survey data were collected during 2007.

Participating students were randomly selected through a two-stage clustered sampling design. First, 115 schools were randomly selected for participation from the 475 schools in NZ (secondary schools and composite schools) with students in years 9 to 13. Schools with fewer than 50 students and Wharekura schools (Māori language schools) were not included in the sampling for the main survey (n = 86). Of the 115 schools, 96 agreed to participate (school response rate = 83%). Of the participating schools, the majority were state funded (67%), co-educational (68%), had more than 350 students (67%) and were in the middle socioeconomic deciles. Students were randomly

selected to participate from the school rolls of participating schools. In total, 9 107 students agreed to participate in the survey (student response rate = 74%). Student response rates by individual schools ranged from 50-96%. Among the most common reasons for students not participating were being absent from school (23%), being unavailable (10%) or declining to take part (9%). School principals consented to participation in the survey on behalf of the Boards of Trustees. Selected students and their parents were provided with information sheets about the survey. Students themselves consented to participate in the study on the day of the survey. The University of Auckland Human Subject Ethics Committee granted ethical approval for the study.

All data were collected during the school day. On the day of the survey, students arrived at a designated room where they were given an anonymous login code to access the survey. The Youth'07 survey included a 622-item multimedia questionnaire administered on an internet tablet, anthropometric measurements, and identification of their census mesh block number (based on their residential address) to determine small-area neighbourhood deprivation.

## Measures

The main outcome variable for the current study was soft drink consumption which was determined from the question: During the last 7 days, how often did you drink any of the following? fizzy or soft drinks (eg Coke, Sprite, Fanta). Participants could then tick the box that best fitted their consumption of each of these groups of drinks from a five point likert-type scale response table. Responses were: a) none in the last 7 days, b) 1 to 3 times a week, c) 4 to 6 times a week, d) once a day, and e) 2 or more times a day. In this study categories c, d and e were combined for analysis for two reasons. Consuming 4+ soft drinks weekly is considered high and the distribution of consumption naturally formed these groups.

Home availability of soft drinks was determined from the question: How often are the following foods available to eat at home? fizzy drinks or soft drinks (eg Coke, Sprite, Fanta). Participants could then tick the box that best fitted their consumption from a four point likert-type scale response table. Responses were: a) never, b) sometimes, c) usually, and d) always. In this study category c) usually and d) always were combined and considered to provide high exposure of soft drinks in the home environment and this group was compared to the Never group.

Parental encouragement to eat healthily was measured using the question: How much does your mum/dad (or someone who acts as a mum/dad) encourage you to eat healthy food? Participants could then tick the box that best described the level of parental encouragement they experienced on a 4 point likert-type scale response table. Responses were: a) not at all, b) a little, c) some d) very much.

All anthropometric measures were taken by trained research staff following standardized procedures and protocols. Height was measured using a portable stadiometer (Seca model 214) to the nearest 0.1 centimetre. Weight was measured using digital scales (Health-o-Meter model 349KLX) to 0.1 kilograms. Body mass index (BMI) was calculated by dividing weight (kilograms) by height squared (meters). Waist circumference measurements were taken at four centimetres above the umbilicus

with a Figure Finder tape measure (Novel Products, Inc).<sup>21</sup>

Age, gender and ethnicity were determined by self report. Ethnicity was assessed using the standard measures developed for the NZ census where participants can select all of the ethnic groups that they identify with.<sup>22</sup> Approximately 40% of students identified with more than one ethnic group.<sup>20</sup> To facilitate statistical analyses, discrete ethnic populations were created using a prioritization method where students were assigned to one ethnic group in the following order: Māori , Pacific, Asian, Other ethnicity, European.

Small area deprivation (NZDep) was determined using the 2006 New Zealand Deprivation Index.<sup>23</sup> The Index measures eight dimensions of deprivation (income, home ownership, support, employment, qualifications, living space, communication, transport) using 2006 census data based on small

area geographical (meshblock) units. The Index deciles were categorized into three groups reflecting low deprivation (1-3), middle levels of deprivation (4-7), and high deprivation (8-10). During the survey, students were asked to orally provide their home address in order to ascertain the small area geographical unit in which they lived. That unit was recorded (not their address) and later matched to the Deprivation Index.

### Analysis

All analyses were conducted using the survey procedures in the SAS software (Cary, NC). Interaction terms were tested in multivariate models to determine if the effects of socioeconomic deprivation on body size (BMI or waist circumference) were consistent by age, gender, and ethnicity. Differences were considered to be statistically significant at  $p < 0.05$ .

## Results

The demographic characteristics for children who did not consume soft drinks in the previous week, consumed 1-3 days (moderate consumers), and 4+ days the week previous (high consumers) is presented in table 1. Boys were both more likely to be consumers (80%) compared to girls (68%) and more likely to be high consumers. Mean frequency of soft drink consumption (not shown) for the entire sample was 2.5 times per week and was 3.5 and 2.0 times per week for boys and girls respectively.

There were strong ethnic differences in consumption with nearly half of Pacific children (48.8%) being high consumers compared to just under a quarter (22.9%) of European children. There was also a strong relationship with deprivation with the most deprived groups being being the highest consumers. There was no clear trend in consumption with age.

**Table 1.** Soft drink consumption by demographic characteristics Youth 2007

Weekly Soft drink consumption	None		1-3 times a week		4+ times a week	
	N	% (95% CI)	%	95% CI	%	95% CI
Total	8697	25.6 (23.8, 25.5)	45.4	(44.5, 48.7)	29.0	(30.1, 35.8)
Boys	4664	20.5 (19.0, 21.9)	46.5	(44.5, 48.7)	33.0	(30.1, 35.8)
Girls	4033	31.7 (28.9, 34.4)	44.0	(42.1, 46.0)	24.3	(21.3, 27.4)
Ethnicity						
European	4633	27.5 (25.2, 29.9)	49.6	(47.7, 51.6)	22.9	(20.8, 24.9)
Māori	1621	20.0 (17.5, 22.4)	40.9	(38.3, 43.7)	39.1	(35.7, 42.4)
Pacific	834	16.1 (13.1, 19.2)	35.1	(31.5, 38.6)	48.8	(43.8, 53.8)
Asian	1098	31.8 (28.6, 35.0)	43.7	(41.3, 46.0)	24.5	(21.6, 27.4)
NZDep						
Wealthier	3164	28.3 (26.0, 30.6)	48.8	(46.6, 51.0)	22.9	(20.6, 25.1)
Middle	3312	27.1 (24.8, 29.3)	46.0	(44.1, 48.0)	26.9	(24.5, 29.3)
Poorer	2139	19.4 (17.0, 21.7)	40.1	(37.7, 42.5)	40.5	(37.1, 44.0)
Other	504	28.8 (24.5, 33.0)	42.0	(37.4, 46.6)	29.2	(24.1, 34.4)
Age						
13	1768	27.9 (25.2, 30.6)	44.8	(42.3, 47.2)	27.3	(24.4, 30.2)
14	2002	25.3 (22.7, 28.0)	42.8	(40.0, 45.6)	31.9	(28.5, 35.3)
15	1897	26.0 (23.4, 28.6)	44.8	(42.3, 47.3)	29.2	(26.2, 32.2)
16	1666	24.2 (21.7, 26.7)	48.2	(45.4, 50.9)	27.6	(24.6, 30.7)
17	1364	24.5 (21.3, 27.7)	47.5	(44.5, 50.4)	28.0	(24.9, 31.2)

**Table 2.** Soft drink consumption by home availability and parental encouragement to eat healthy

		None		1-3 times a week		4+ times a week	
Availability of soft drink at home							
	N	%	(95% CI)	%	95% CI	%	95% CI
Usually	2789	8.4	(28.9, 34.4)	33.8	(28.9, 34.4)	57.8	(28.9, 34.4)
Never	5860	33.9	(31.8, 36.1)	51.0	(49.1, 52.8)	15.1	(13.3, 17.0)
Mum encourages participant to eat healthy							
Very much	4787	29.9	(27.8, 32.1)	45.5	(43.7, 47.1)	24.6	(22.2, 27.1)
Not at all	3842	20.3	(18.5, 22.1)	45.6	(43.4, 47.7)	34.1	(31.5, 36.8)
Dad encourages participant to eat healthy							
Very much	5271	29.3	(26.7, 31.8)	43.8	(41.6, 46.0)	26.9	(24.5, 29.3)
Not at all	3182	23.3	(24.8, 29.3)	46.7	(44.8, 48.6)	30.0	(27.5, 32.5)

Table 2 presents soft drink consumption by two home-related environmental factors. Children who lived in homes where soft drinks were available 'usually or always' were nearly 4 times more likely to be high consumers compared to children who lived in homes where soft drinks were never available.

In contrast, parental encouragement to eat healthily, had a much weaker association with consumption, although significantly more children of

parents who encouraged a healthier diet had not consumed soft drink in the previous seven days and these children were also less likely to be high consumers. It made little difference whether the encouragement to eat healthily came from mothers rather than fathers.

**Table 3.** Multiple logistic regression BMI and Waist with weekly soft drink consumption

Soft drink frequency per week	BMI					Waist				
	n	Mean†	B coeff*	SE	P	n	Mean†	B coeff*	SE	P
None	2200	22.6	-	-		2234	83.1	-	-	
1-3	3894	22.7	0.004	0.17	0.9961	3951	85.0	2.129	2.48	0.0497
4+	2461	23.2	0.013	0.14		2512	94.3	7.195	2.91	

† Unadjusted mean BMI or waist (cm), \* Adjusted for age, sex, NZDep, ethnicity

Two multiple logistic regression models adjusted for age, sex, NZDep and ethnicity were constructed to assess the association between soft drink consumption and BMI and waist circumference. Increasing BMI was weakly associated with higher soft drink consumption although the

association was not statistically significant. There was a stronger and significant association between high soft drink consumption and increased waist circumference (p<0.05).

**Discussion**

This study has provided more information about soft drink consumption patterns of NZ high school students based on the most recent national survey data, although it is now 6 years out of date and need updating. Similar to surveys in other countries, consumption was higher in males, among those who were more socioeconomically deprived and in ethnic minorities.<sup>24,25</sup> Compared to a 2006 Canadian study that reported an average of 5.5 servings of soft drink per week among high school students,<sup>26</sup> it appears that high school students in NZ consume soft drinks about half as often (average 2.5 times per week). While it is difficult to compare these data directly as no volumes were recorded, previous research has found that NZ

children have similar drink sizes to United States (US) children.<sup>27</sup>

A limitation of this present study is that there is an inability to delineate between sugar-sweetened versus artificially-sweetened soft drinks (i.e. diet or Zero versions that are sugar-free). Given the increasing popularity of artificially sweetened soft drinks, future surveys need to address this problem.

The higher level of consumption in boys, Pacific and Māori as well as those in more deprived areas indicates that intervention strategies may need to be targeted. Furthermore, the strong influence that home availability appears to have on soft drink consumption (Table 2) suggests that the home environment is also a major determinant of soft drink consumption

for NZ youth. This finding is supported by other research conducted in the US and Australia that identified the home as the largest source of youth soft drink access.<sup>28, 29</sup>

Factors that drive high consumption of soft drinks are well researched internationally and should be used to inform public health strategies to reduce consumption. Key elements found to influence consumption include parental factors, peers/friends, taste, school availability, and television viewing.<sup>30-32</sup> Our finding suggesting that home availability has a very strong influence on soft drink consumption presents a clear and simple action that could significantly reduce consumption among NZ youth. The elimination of soft drinks from the home environment should be a priority goal for public health.

Although targeting changes in the home environment needs to be a priority, similar efforts should be continued in schools and elsewhere that at-risk youth spend their time. A study that evaluated the impact of a state implemented beverage policy in US schools found that for one fifth of students the school policy also impacted on what they drank at home/ outside of school and that students thought that a reduction of beverage consumption at school was necessary to reduce

consumption elsewhere.<sup>33</sup>

Although not a primary aim, our study found a significant association between increased soft drink consumption and greater waist circumference, but only a non significant trend for BMI. This is not unexpected as this study had relatively numbers, was cross sectional, and was comprised of youth aged 13 - 17 years. Other studies have reported significant associations between soft drink consumption and overweight.<sup>34-37</sup> Furthermore, it is expected that BMI is not as sensitive for young people due to growth and maturity, and that waist circumference is a better measure of adiposity.<sup>38</sup>

## Conclusion

This study presents the most current and most comprehensive information on soft drink consumption patterns of New Zealand youth and highlights factors associated with high consumption. These findings suggest that in conjunction with minimising availability of soft drinks in schools, reducing the availability of soft drinks in the home would significantly reduce consumption of soft drinks among New Zealand youth.

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