

See discussions, stats, and author profiles for this publication at: <https://www.researchgate.net/publication/46051787>

Soft drinks, weight status and health: health professional update

Article · January 2009

Source: OAI

CITATIONS

4

READS

186

5 authors, including:



Jimmy Chun Yu Louie

The University of Hong Kong

184 PUBLICATIONS 2,137 CITATIONS

[SEE PROFILE](#)



Vicki Flood

The University of Sydney

329 PUBLICATIONS 6,902 CITATIONS

[SEE PROFILE](#)



Debra J Hector

Cancer Australia

42 PUBLICATIONS 1,232 CITATIONS

[SEE PROFILE](#)



Anna Rangan

The University of Sydney

148 PUBLICATIONS 2,244 CITATIONS

[SEE PROFILE](#)

Some of the authors of this publication are also working on these related projects:



Chronic kidney disease [View project](#)



Secondary analysis of the National Nutrition and Physical Activity Survey of Australia 2011/12 [View project](#)

SOFT DRINKS, WEIGHT STATUS AND HEALTH

2009

HEALTH PROFESSIONAL UPDATE



Anna Rangan, Debra Hector, Jimmy Louie, Vicki Flood, Tim Gill
NSW Centre for Public Health Nutrition

SOFT DRINKS, WEIGHT STATUS AND HEALTH: HEALTH PROFESSIONALS UPDATE

Anna Rangan, Debra Hector, Jimmy Louie, Vicki Flood, Tim Gill

NSW Centre for Public Health Nutrition

Suggested citation: Rangan A, Hector D, Louie J, Flood V, Gill T (2009). Soft drinks, weight status and health: health professionals update. Sydney: NSW Centre for Public Health Nutrition (now known as the Cluster of Public Health Nutrition).

This work is copyright. It may be reproduced in whole or in part for study training purposes subject to the inclusion of an acknowledgment of the source and no commercial usage or sale.

© NSW Cluster of Public Health Nutrition

For more information please contact:

Cluster of Public Health Nutrition
Level 2, K25 Medical Foundation Building
The University of Sydney NSW 2006

Tel: +61 2 9036 3005 Fax: +61 2 9036 3184
<http://www.cphn.mmb.usyd.edu.au>

Download copies of this report from the Cluster of Public Health Nutrition's website:
<http://www.cphn.mmb.usyd.edu.au>

The NSW Cluster of Public Health Nutrition gratefully acknowledges funding by NSW Health for the development of this report.

June 2009

Executive summary

High consumption of soft drinks and other sugary drinks are associated with a number of health problems, including overweight and obesity, type 2 diabetes, osteoporosis and dental caries. In Australia, soft drinks are the most commonly consumed sugary beverage and have been singled out for specific attention as a target of obesity prevention programs. Soft drinks are well-known, readily available and marketed extensively, especially to adolescents. They have no nutritional value other than sugar and fluid, and are identified in the *Australian Guide to Healthy Eating* as an 'extra' food – one that should be consumed only occasionally and in small amounts.

Consumption of soft drinks in Australia is high, ranking in the top 10 countries based on market share. These consumption levels are supported by data from a variety of sources such as apparent consumption surveys, nutritional surveys and the beverage industry. Adolescents, particularly males consume the most, with per-consumer consumption in these groups reaching almost a litre per day. Soft drinks contribute up to 10% of energy intake in adolescents. A number of personal, social, cultural and environmental factors are associated with increased soft drink consumption, including taste, parental consumption, parenting styles, social status and cultural background.

The evidence linking soft drinks consumption to overweight and obesity is now strong. A number of systematic reviews and meta-analyses have shown that the evidence comes from a large number of studies of various types, and that studies of greater methodological power show greater strength of association. In addition, there is strong biological plausibility with evidence of a dose-response relationship. This evidence is strong enough to warrant intervention.

The benefits of reducing soft drink consumption include reduced overweight and obesity, reduced risk of some chronic diseases and improved dental health. As awareness about the health risks of soft drinks and desire to change this behaviour appear to be low, a social marketing program with a long term focus represents a promising strategy. Four behaviour change options, or 'messages', to consider include:

- reduce uptake of soft drink consumption by young children
- reduce frequency and quantity of consumption
- replace soft drinks with artificially-sweetened drinks
- replace soft drinks with water.

Strategies aimed at individual changes in behaviour are more likely to be successful if environmental changes are implemented at the same time. These could include:

- restricting access
- price increases through taxation
- limiting portion size
- restricting marketing to children
- improved labelling or nutrition signposting
- product reformulation.

Suitable messages for selected target populations are included in this update to assist in actions to reduce soft drink consumption.

CONTENTS

EXECUTIVE SUMMARY	2
CONTENTS	4
ABBREVIATIONS AND TERMINOLOGY	5
1. INTRODUCTION	6
Background.....	6
Purpose of this report.....	6
2. SOFT DRINK CONSUMPTION IN NSW AND AUSTRALIA	7
3. THE HEALTH IMPLICATIONS OF SOFT DRINKS CONSUMPTION.....	9
Obesity.....	9
Other health implications of soft drinks	10
4. POTENTIAL STRATEGIES TO REDUCE SOFT DRINK CONSUMPTION	12
Behaviour changes	12
Social marketing.....	13
Environmental strategies	13
5. CONCLUSIONS	16
6. SUITABLE MESSAGES FOR SELECTED GROUPS	17
LITERATURE CITED.....	19

ABBREVIATIONS AND TERMINOLOGY

cal	calories
CPHN	NSW Cluster for Public Health Nutrition
FAO	Food and Agriculture Organization
kJ	kilojoules
l	litres
ml	millilitres
NGO	non-government organisation
NHMRC	National Health and Medical Research Council
NNS	National Nutrition Survey
USA	United States of America

The term ‘soft drink’ in this report refers to carbonated beverages. If no adjective is used, then the term refers to regular or sugar-sweetened soft drinks. In Australia, the sugar added is sucrose.

Sometimes, the term ‘soft drinks’ includes artificially-sweetened or ‘diet’ carbonated beverages. Where this is the case, we have clarified meaning in the surrounding text. Other terminology includes ‘sugary drinks’ – which encompasses carbonated sugar-sweetened soft drinks as well as fruit juices, fruit drinks, cordials, iced teas, sports drinks and energy drinks.

1. INTRODUCTION

Background

A high intake of sugary drinks contributes to obesity and other adverse health outcomes such as type 2 diabetes, metabolic syndrome, dental caries and osteoporosis. Children who consume large amounts of sugary drinks may also have poor nutritional intake due to the displacement of milk from the diet (Cook et al 2001, Harnack et al 1999).

Soft drinks, or sugar-sweetened carbonated beverages, are the most popular sugary drinks in Australia. They are consumed by large proportions of the population in large quantities. They are well known, readily available and marketed extensively, especially to adolescents. Soft drinks are a rich source of sugar and energy, with one regular can containing 10 teaspoons of sugar and 640 kJ (150 cal). But, other than fluid, they provide no nutritional value – only ‘empty’ calories (Jacobson 2005). They are identified as an ‘extra’ food in *The Australian Guide to Healthy Eating* (Smith et al 1998) i.e. a food that should be consumed only occasionally or in small amounts. Occasionally has been defined as "once a week or less" by The Communication on Obesity Action for Child Health (COACH) Reference Group (Wilde et al 2007), which represented the major NGO and professional groups communicating on childhood obesity issues in Australia.

Purpose of this report

This report provides a brief overview of the current knowledge and understanding surrounding soft drink consumption in NSW and Australia. It is a summary of a more comprehensive review conducted for NSW Health (Hector et al 2009). This information can be used to support evidence-based policy and planning to reduce the consumption of soft drinks in NSW and Australia. This report also suggests suitable messages for health promotion appropriate for specific age groups.

2. SOFT DRINK CONSUMPTION IN NSW AND AUSTRALIA

Soft drink consumption in NSW and Australia has increased dramatically over the past decades, with Australia now ranking in the top 10 countries based on market share (Beverage Digest 2006). Apparent consumption data, based on national food balance sheets, indicate that soft drink consumption (both regular and diet) increased by 240% between 1969 and 1999 to 113 l per person per year, or 300 ml per person per day (Australian Bureau of Statistics 1998). Since then, sales figures indicate that this rapid growth has slowed, with an increase of just 5% between 1997 and 2006 (Levy and Tapsell 2007). This increase was mainly due to a growth in sales of diet soft drinks, with sales of regular soft drinks relatively stable. The sales of sports drinks, drink mixers (used with alcoholic drinks) and energy drinks are also growing (Levy and Tapsell 2007).

The most recent National Nutrition Survey (NNS), in 1995, provides more detailed information. On the day of the survey, soft drinks were consumed by about a quarter of 2–7 year olds, a third of 8–15 year olds and half of 16–18 year olds. Daily per capita intake increased with age, from 53 ml for 2–3 year olds to 364 ml for 16–18 year olds (Figure 1). Also, daily per consumer intake (the average intake among those who consumed soft drinks) increased with age, rising from 222 ml for 2–3 year olds to 714 ml for 16–18 year olds. Boys and girls consumed similar amounts until the age of 12. From that age on, boys consumed more than girls. At age 16–18 years, the daily per capita consumption was 480 ml for boys and 240 ml for girls. Among those who consumed soft drinks on the day of the survey, the average consumption was 836 ml for boys and 545 ml for girls, representing 10.8% of total energy intake for both boys and girls aged 16–18 years.

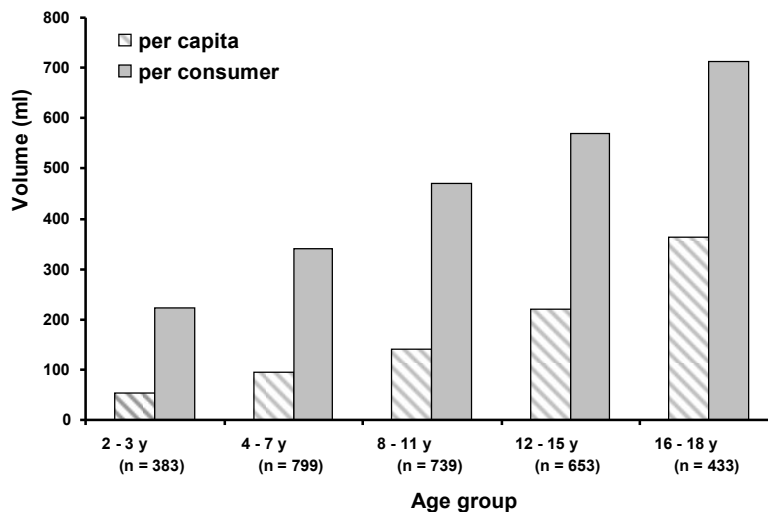


Figure 1: Volume of sugar-sweetened soft drinks consumed among children aged 2–18 years by different age groups, data from the 1995 National Nutrition Survey; analysis by the NSW Cluster for Public Health Nutrition

Among adults, the highest consumers of soft drinks were males aged 19–24 years, with 58% consuming an average of 802 ml per day (Figure 2). The next highest consumers were males aged 25–44 years, with 34% consuming an average of 642 ml, and females aged 19–24 years, with 36% consuming an average of 562 ml. Consumption decreased with age thereafter.

Other surveys confirm the findings of the NNS that adolescents and young adults, especially males, are the main consumers of soft drinks, although younger children (toddlers) also consume significant amounts (Food Standards Australia New Zealand 2003, Webb et al 2006).

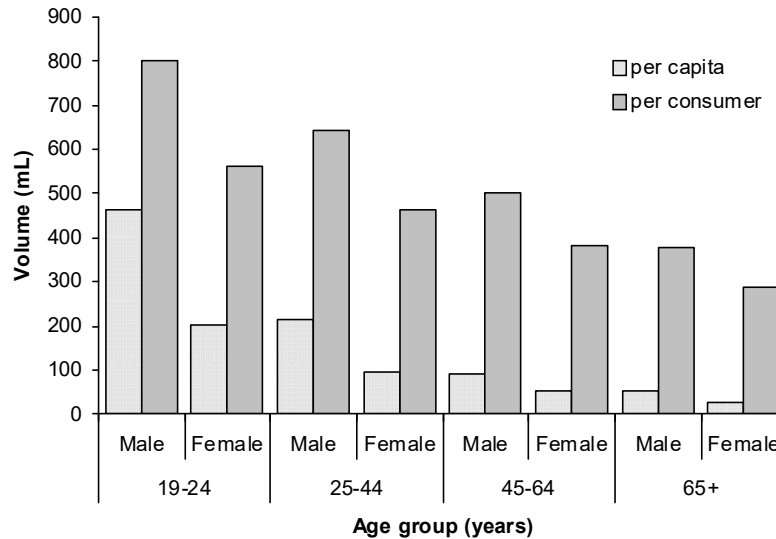


Figure 2: Volume of sugar-sweetened soft drinks consumed among adults in Australia, by age and sex; data from the 1995 National Nutrition Survey; analysis by NSW Cluster for Public Health Nutrition

Other demographic factors are important (Hector et al 2008). Higher consumption is associated with:

- socio-economic status – non-professional occupations and the most socio-economically disadvantaged
- cultural background – Indigenous Australians and those with a Southern European or Middle Eastern background
- geographical location – those living in South Australia and the Northern Territory.

Soft drink consumption is also associated with a number of personal and environmental factors. Taste is one such factor. Adolescents prefer the taste of soft drinks while younger children prefer the taste of still fruit-flavoured drinks (May and Waterhouse 2003). Those with the strongest taste preference for soft drinks consume more than those with lesser taste preferences (Grimm et al 2004). Parental influences such as parental consumption and parenting style are also important factors. Children whose parents regularly drink soft drinks are more likely to consume soft drinks than children whose parents do not consume soft drinks regularly (Vereecken et al 2004). Restrictive parenting practices and parental involvement have been found to be associated with less soft drink consumption (de Bruijn et al 2007, van der Horst et al 2007). Environmental factors associated with increased intake are the availability of soft drinks, especially in the home (Grimm et al 2004, Kassem and Lee 2004), portion size (including the small price differential for larger portions) (Flood et al 2006, Rolls et al 2007), and the level of exposure to marketing (James et al 2002).

3. THE HEALTH IMPLICATIONS OF SOFT DRINKS CONSUMPTION


Obesity

Evidence of an association

There has been debate about the strength of the relationship between the consumption of sugary drinks and obesity. Some authors/reviewers conclude that the evidence on this topic is equivocal and that unsatisfactory methodological rigour in many of the experimental and prospective studies makes it difficult to draw firm conclusions (Drewnowski and Bellisle 2007, Pereira 2006). However, the majority of systematic reviews and meta-analyses support the view that sugary drinks, particularly soft drinks, have a causative role in obesity (Malik et al 2006, Taylor et al 2005, Vartanian et al 2007).

Out of 42 studies identified in the above systematic reviews, 26 showed a significant positive association between sugary drink (mainly soft drink) consumption and weight gain, and no studies showed a negative association (Table 1). As the methodological strength or power of the studies increase, i.e. from cross-sectional to prospective through to experimental, the proportion of studies showing a positive association between sugary drinks and weight increases, as does the strength of effect.

Table 1. Number of studies of linking sugary drinks, particularly soft drinks, to obesity (sourced from Malik et al 2006, Taylor et al 2005, Vartanian et al 2007)

Association	Increasing strength of evidence 			Total number of studies
	Cross-sectional studies	Prospective studies	Experimental (E)/ Intervention (I) trials	
Positive ($p < 0.05$)	13	8	3 E / 2I	26
None/not-significant ($p > 0.05$)	12	4	0	16
Negative ($p < 0.05$)	0	0	0	0

The potential contribution of soft drinks to weight gain are supported by the results of three small clinical trials in adults (DiMeglio and Mattes 2000, Raben et al 2002, Tordoff and Alleva 1990) and two longer-term intervention trials in children (Ebbeling et al 2006, James et al 2004). These trials showed that a decrease in soft drink consumption resulted in a reduction in BMI among adolescents in the highest BMI tertile (Ebbeling et al 2006) or at least an attenuation in weight gain (James et al 2004).

The systematic reviews found that associations between soft drink consumption and total energy intake were stronger than those that examined the relationship between soft drink consumption and body weight. This finding was not surprising given that soft drinks are not the only source of energy in the diet. All reviews concluded that the available evidence was sufficient to recommend public health strategies to reduce soft drink consumption (Malik et al 2006, Taylor et al 2005, Vartanian et al 2007).

Evidence of causality

A causal relationship appears likely, as many of the conditions necessary to establish a causal relationship (Hill 1965) are met from the evidence:

- Statistically significant associations indicating a temporal relationship have been identified in at least eight prospective or longitudinal studies, i.e. soft drink consumption preceded the weight gain.
- The relationship shows consistency – it is found in various age, sex and racial sub-groups and with varying socio-economic status.
- A dose-response effect has been observed in at least four longitudinal studies (Berkey et al 2004, Ludwig et al 2001, Phillips et al 2004, Striegel-Moore et al 2006) and this, in particular, provides sufficient evidence of causality (Dietz 2006).
- A plausible biological mechanism has been identified. There is strong and consistent evidence regarding the association between soft drinks and increased energy intake (Vartanian et al 2007) as there appears to be limited compensation for this increased energy intake by reducing intakes of other foods (Vartanian et al 2007, Wolf et al 2008).
- The relationship does not conflict with current knowledge about weight gain.

Other health implications of soft drinks

Chronic disease

Data from two large cohort studies have shown that higher consumption of sugar-sweetened beverages is associated with an increased risk of type 2 diabetes and metabolic syndrome (Dhingra et al 2007, Schulze et al 2004).

Dental health

Soft drinks are acidic beverages and contain large amounts of sugar, properties which contribute to enamel erosion and dental caries. In the 2003 report on *Diet, Nutrition and Chronic Disease* (Joint WHO/FAO Expert Consultation 2003), WHO found the evidence for the association between soft drink and fruit juice consumption and risk of dental erosion to be 'probable' and the evidence of free sugars contributing to dental caries to be 'convincing'. The Australian Dental Association discourages the frequent consumption of soft drinks as well as diet soft drinks, sports drinks and fruit juices due to their high sugar and/or acid content (Australian Dental Association 2002).

Bone health

Preliminary research suggests an association between soft drink consumption, mostly cola-type drinks, and bone mineral density and/or fractures in children (Ma and Jones 2004, McGartland et al 2003, Petridou et al 1997, Wyshak 2000) and older women (Tucker et al 2006). This may be due to the displacement of milk consumption or to a direct effect of soft drink components. Caffeine has been shown to increase the excretion of calcium in the urine, and phosphoric acid may interfere with calcium absorption (Fernando et al 1999, Kynast-Gales and Massey 1994).

Displacement of core foods from diet

Soft drinks can displace healthier food and beverage choices. A high level of soft drink consumption is associated with lower intakes of vitamins A, C and folate, calcium and magnesium (Ballew et al 2000, Harnack et al 1999). Higher soft drink consumption among children and adolescents is especially associated with a decline in milk consumption (Blum et al 2005, Lytle et al 2000, Striegel-Moore et al 2006). This reduced milk consumption has implications, particularly among adolescent girls, for short-term and long-term bone health.

Caffeine

Caffeine is present in cola-type soft drinks, both regular and diet, and in energy drinks. It is a mildly addictive stimulant drug which can cause disturbed sleep patterns, bedwetting and anxiety in children and young adults. Withdrawal symptoms such as headache, fatigue, decreased alertness, depressed mood and irritability can be experienced 6–24 hours after caffeine abstinence, even for low doses (Juliano and Griffiths 2004).

4. POTENTIAL STRATEGIES TO REDUCE SOFT DRINK CONSUMPTION

Which strategies most effectively reduce soft drink consumption are not known – there have been too few intervention trials (Hattersley and Hector 2008). It is likely that a combination of strategies will be needed to achieve and sustain behavioural changes. A range of potential health promotion and environmental strategies have been proposed and some of these are examined below.

Behaviour changes

There are a number of individual behaviour changes which would lead to a population level decline in soft drinks consumption. Four broad categories of behaviour change are indicated.

1. Reduce uptake of soft drinks by young children

Preventing young children acquiring a taste for soft drinks would likely lead to a fall in soft drink consumption over time. The aims would be to stop toddlers consuming soft drinks at all, and to reduce the frequency and quantity of consumption among those who do.

2. Reduce frequency and quantity of consumption

The high level of soft drink consumption among Australians means that small reductions in intake should be relatively easy to achieve and will reduce total energy intake. However, relying on this strategy requires constant and consistent reinforcement of the message and there is a potential for soft drinks to be replaced with other sugary beverages.

3. Replace soft drinks with artificially sweetened beverages

Using artificial sweeteners as a substitute for sugar may help people reduce their energy intake without changing the taste of soft drinks significantly. This approach has been advocated by several researchers (Chacko et al 2003), and is likely to be the simplest behaviour change. Intervention studies using this approach resulted in a reduction in body weight in adults (Tordoff and Alleva 1990) and had a beneficial effect on body weight in adolescents in the highest BMI tertile (Ebbeling et al 2006).

However, some concerns have been raised using this approach. Consumers of diet drinks may compensate for the low kilojoule beverages by consuming more high-energy snacks, leading to an overall higher energy intake (Lavin et al 1997, Swithers and Davidson 2008). In addition, over-consumption of diet soft drinks can lead to dental erosion, bone demineralisation and other adverse effects from those diet drinks containing caffeine. Mixed alcoholic drinks made with a diet mixer are absorbed more quickly than those made with a sugar-sweetened mixer (Wu et al 2006), so the use of diet drinks in association with alcohol might not be advisable.

4. Replace soft drinks with water

There is some evidence that replacing soft drinks with water can help lower total energy intake in people who are overweight. Stookey et al found significant decreases in total energy intake sustained over 12 months when overweight women replaced sugar-sweetened beverages with water (Stookey et al 2007).

An Australian study, *The 'Fresh Kids' program*, aimed to influence the lunchbox contents and canteen orders for sweet drinks and water among primary school children over a two year period (Laurence et al 2007). The introduction of water and soft drink policies in the classrooms and the distribution of student-designed water bottles resulted in an increased proportion of students bringing filled water bottles to school and a decreased proportion of children bringing sugary drinks to school. Unfortunately, the study did not assess whether any compensation occurred during the day. Nevertheless, whole-of-school strategies to promote

replacement of sugary drinks with water are considered a promising option for intervention (Hattersley and Hector 2008).

Studies conducted in high school children are less conclusive. A British study found that a nutrition education campaign combined with the provision of water fountains increased water consumption, but there was no decline in soft drink sales (Loughridge and Barratt 2005). These results are supported by a qualitative study in the USA which noted that adolescents are willing to drink more water, but are not willing to give up soft drinks (Wilson 2007).

Other difficulties may arise. Water may not have an immediate appeal to high soft drink consumers. The poor availability of water in public places and the high price of bottled water are likely deterrents to increased water consumption in children and those of lower socio-economic status. The use of refillable water containers is preferred as these are more environmentally friendly and overcome the issue of un-fluoridated bottled water.

Social marketing

Research on attitudes to soft drink is limited, especially in Australia. However, the available evidence suggests there is little awareness of the health consequences of excessive consumption, and there is little impetus to change behaviour. Social marketing is one strategy which can be used to raise awareness and achieve dietary change.

Although social marketing interventions aimed at improving nutrition are relatively new, there is some evidence they can be highly effective among most target groups and in most settings (Gordon et al 2006, Thornley et al 2007). Unfortunately, the evidence to rate the effectiveness of social marketing for sugar-sweetened beverages is limited due to the small number of studies (Thornley et al 2007). More in-depth investigations of the factors affecting soft drink consumption with different target groups are needed to inform campaign messages.

Environmental strategies

Individual behaviour change is more likely in an environment which makes healthier choices easier choices. Some of the key environmental issues influencing soft drink consumption have been identified in Table 2 (Jacobson 2005, Joint WHO/FAO Expert Consultation 2003, World Health Organization Europe 2007). To date, there has been very little research investigating the efficacy or potential to alter factors within the environment which encourage soft drink consumption, or which inhibit a switch to a more appropriate behaviour. However, other public health issues have demonstrated the importance of attempting to address these issues.

Table 2. Key environmental strategies to facilitate reduced soft drink consumption

- **Reducing access to soft drinks**
- **Price increase through taxation**
- **Reducing portion sizes**
- **Restricting marketing to children**
- **Improved labelling and packaging**
- **Product reformulation**

Reducing access to soft drink

A number of government agencies have already moved to reduce the access of children to soft drink and increase their access to alternative beverages, in particular water. Soft drinks have been banned for sale from schools in NSW, Victoria and South Australia, and their sale is restricted in most others. These restrictions could be extended to other government institutions such as hospitals and state-controlled recreation and sporting venues. However, it is difficult to directly influence the ready access to soft drinks in most other public places in Australia, and a preferable strategy here may be to improve access to alternative beverages. The provision of clean and free water in public places may decrease the demand for sweetened drinks.

Price increase through taxation (snack tax)

The introduction of a tax on soft drinks and other snack/junk foods has been the subject of considerable discussion in past years (Battle and Brownell 1996). Although economic modelling suggests that alone it will not have a sizeable impact on consumption (Goodman and Anise 2006), it may still be a useful tool if combined with other strategies. A recent study reported lower prevalence of obesity in US states that imposed taxes on soft drinks or snack foods between 1991 and 1998 compared to those states that did not impose such a tax (Kim and Kawachi 2006). The revenues could potentially be used to fund nutrition education programs or subsidise the cost of core, healthier foods such as fruit and vegetables (Battle and Brownell 1996, Brownell 1994, Kim and Kawachi 2006, Kuchler et al 2004).

Reducing portion sizes

The size of soft drink containers has increased 2–3 fold over the last 50 years; from 200 ml in the 1950s to the 390 ml and 600 ml bottles which are commonly consumed today. An increase in portion size contributes to overconsumption of energy intakes and may lead to excess body weight (Matthiessen et al 2003, Young and Nestle 2002). Although there have been no intervention studies to date which have focussed on portion size, a reduction in the size of soft drink containers would appear to be a prudent measure.

Restricting marketing to children

Exposure to food and beverages advertising via TV is associated with a higher consumption of soft drinks (Feldman et al 2007), and there is some evidence to suggest that the increase in proportion of overweight children in countries which limit 'junk-food' advertising has been slower than in those without such limits (Lobstein and Dobb 2005). Other forms of marketing such as websites, children's magazines, product placement and star endorsements are becoming more popular and will also need to be targeted (Kelly and Chapman 2007). Restricting marketing of soft drinks to children will require considerable action across many sectors, but local action can be implemented at the level of schools, workplaces, sports events and community settings.

Improved labelling and packaging

This could include 'front of package' approaches that support the reduction of intakes of energy-dense, nutrient-poor foods (Louie et al 2008). Other suggested strategies to discourage soft drinks consumption include labelling with either a warning message, e.g. 'excessive consumption of soft drinks can lead to undesirable weight gain', and/or the energy content of the beverage in the container in big print. A recent study by Bergen and Yeh demonstrated that a bright-coloured '0 calorie, 0 carbs' label on the selection panels together with motivational posters around vending machines which sold drinks significantly encouraged university students and staff to select either bottled water or diet soft drinks over regular soft drinks (Bergen and Yeh 2006).

Product reformulation

Reducing the sugar content of soft drinks and other sugar-sweetened beverages could assist in reducing the health risks of soft drink consumption. However, these products may still encourage children to desire flavoured and sweet tasting products.

5. CONCLUSIONS

The evidence linking soft drink consumption to weight gain and obesity is sufficiently strong to take action. Individual behaviour changes which would result in a population level decline in soft drink consumption include:

- reducing the uptake of soft drink consumption by young children
- reducing frequency and quantity of consumption
- substituting soft drinks with artificially-sweetened beverages
- substituting soft drinks with water.

These individual behaviour changes need to be supported by creating an environment which makes healthier choices easier choices. Improved access and availability of healthier alternatives, particularly water, and concurrent reduced access and availability to soft drinks is required. Other environmental initiatives include price increases, reducing portion sizes, restriction of marketing to children and adolescents, changing labelling, and product reformulation of soft drinks.

A social marketing campaign could target both the individual and the environment. More information is required on factors affecting soft drink consumption in the different target groups to inform campaign messages.

A focus on the family unit is an important element of a whole population strategy as many nutrition beliefs, attitudes and behaviours are modelled by parents to children. Also, parents buy the household food and drinks consumed by children. They are an important group to target in order to limit uptake of soft drinks in young children, and to prevent them from becoming high risk consumers.

The following groups have been identified as high risk consumers:

- teenagers, especially males, and particularly those of Middle Eastern and Southern European descent
- adults aged 19–24 years
- Indigenous people
- families of low socio-economic status.

6. SUITABLE MESSAGES FOR SELECTED GROUPS

The following messages could be promoted in health promotion interventions designed to reduce soft drink consumption. These messages support the *Dietary Guidelines for Australian Children and Adults* (NHMRC 2003a, NHMRC 2003b), the *Australian Guide to Healthy Eating* (Smith et al 1998), findings of the recent CPHN report: *Soft drinks, weight status and health; a review* (Hector et al 2008) and a *Guidance system for beverage consumption in the United States* (Popkin et al 2006).

Target group: Parents/caregivers

- Soft drinks are an 'extra' food and should be consumed once a week or less, and in small amounts.
- Consumption of sugar-sweetened drinks, artificially-sweetened drinks and juices contribute to a 'sweet palate'.
- The adverse health consequences of excessive soft drink consumption are substantial.
- Avoid buying soft drinks and limit availability at home.
- Lead by example, i.e. reduce your own consumption.
- Serve water with meals.
- Offer water and reduced-fat milk instead (whole milk is recommended for children under 2 years of age).
- Use a refillable water bottle.

Target group: Very young children (< 5 years)

- Avoid consumption of all soft drinks and other sugar-sweetened beverages.
- Avoid consumption of all diet soft drinks and other artificially sweetened beverages.
- Water and reduced fat milk (whole milk is recommended for children under 2 years of age) are preferred beverages.
- Limit fruit juice consumption to one small glass (150 ml) per day; dilute with water.
- Water is the best beverage to quench thirst.
- Serve water with meals.
- Use a refillable water bottle.

Target group: Primary school-aged children (approx 6–11 years)

- Limit soft drink consumption to once a week or less, and in small amounts.
- Water and reduced-fat milk are preferred beverages.
- Limit fruit juice consumption to no more than one cup (250 ml) per day.
- Water is the best beverage to quench thirst.

- Serve water with meals.
- Use a refillable water bottle.

Target group: High school-aged children (approx 12–17 years)

- Limit soft drink consumption to once a week or less, and in small amounts.
- Restrict the consumption of diet soft drinks.
- Water and reduced-fat milk are preferred beverages.
- Limit fruit juice consumption to no more than one cup (250 ml) per day.
- Avoid energy drinks.
- Serve water with meals.
- Use a refillable water bottle.

Target group: Young adults (approx 18–25 years)

- Limit consumption of soft drinks.
- Water and reduced-fat milk are preferred beverages.
- Unsweetened tea and coffee are suitable to drink in moderate amounts.
- Avoid frequent consumption of diet soft drinks.
- Avoid frequent consumption of fruit juice.
- Restrict intake of energy drinks.
- Serve water with meals.
- Use a refillable water bottle.

Health professionals to consider

- Health professionals should raise awareness of the adverse health consequences of soft drink consumption among parents, teenagers and young adults.
- Efforts to reduce soft drink consumption among young adults in particular should not conflict with health promotion strategies to reduce alcohol consumption.

LITERATURE CITED

- Australian Bureau of Statistics. Apparent Consumption of Foodstuffs, Australia (Cat. No. 4306.0). Canberra, Australia Bureau of Statistics, 1998.
- Australian Dental Association. Policy Statement 1.2.2 - Diet and Nutrition. St Leonards, 2002, vol 2007.
- Ballem C, Kuester S, Gillespie C (2000). Beverage choices affect adequacy of children's nutrient intakes. *Arch Pediatr Adolesc Med* **265**: 1148-1152.
- Battle EK, Brownell KD (1996). Confronting a rising tide of eating disorders and obesity: treatment vs. prevention and policy. *Addictive Behaviours* **21**: 755-765.
- Bergen D, Yeh M-C (2006). Effects of energy-content labels and motivational posters on sales of sugar-sweetened beverages: stimulating sales of diet drinks among adult study. *J Am Diet Assoc* **106**: 1866-1869.
- Berkey CS, Rockett HR, Field AE, Gillman MW, Colditz GA (2004). Sugar-added beverages and adolescent weight change. *Obes Res* **12**: 778-788.
- Beverage Digest. The Green Sheet 2005 All-Channel Carbonated Soft Drink Corporate Shares in 95 Countries, 2006.
- Blum JW, Jacobsen DJ, Donnelly JE (2005). Beverage consumption patterns in elementary school aged children across a two-year period. *J Am Coll Nutr* **24**: 93-98.
- Booth M, Okely AD, Denney-Wilson E, Hardy L, Yang B, Dobbins T. NSW Schools Physical Activity and Nutrition Survey (SPANS) 2004: Full Report. Sydney, NSW Department of Health, 2006.
- Brownell K. Get slim with higher taxes: New York Times, 1994, p A29.
- Chacko E, McDuff I, Jackson R (2003). Replacing sugar-based soft drinks with sugar-free alternatives could slow the progress of the obesity epidemic: have your Coke and drink it too. *The New Zealand Medical Journal* **116**: U649.
- Cook T, Rutishauser I, Seelig M. Comparable data on food and nutrient intake and physical measurements from the 1983, 1985 and 1995 national nutrition surveys. Canberra, Australian Food and Nutrition Monitoring Unit, 2001.
- de Bruijn GJ, Kremers SP, de Vries H, van Mechelen W, Brug J (2007). Associations of social-environmental and individual-level factors with adolescent soft drink consumption: results from the SMILE study. *Health Educ Res* **22**: 227-237.
- Dhingra R, Sullivan L, Jacques PF, Wang TJ, Fox CS, Meigs JB *et al* (2007). Soft drink consumption and risk of developing cardiometabolic risk factors and the metabolic syndrome in middle-aged adults in the community. *Circulation* **116**: 480-488.
- Dietz WH (2006). Sugar-sweetened beverages, milk intake, and obesity in children and adolescents. *The Journal of Pediatrics* **148**: 152-154.
- DiMeglio DP, Mattes RD (2000). Liquid versus solid carbohydrate: effects on food intake and body weight. *Int J Obes Relat Metab Disord* **24**: 794-800.
- Drewnowski A, Bellisle F (2007). Liquid calories, sugar, and body weight. *Am J Clin Nutr* **85**: 651-661.

Ebbeling CB, Feldman HA, Osganian SK, Chomitz VR, Ellenbogen SJ, Ludwig DS (2006). Effects of decreasing sugar-sweetened beverage consumption on body weight in adolescents: a randomized, controlled pilot study. *Pediatrics* **117**: 673-680.

Feldman S, Eisenberg ME, Neumark-Sztainer D, Story M. (2007) Associations between watching TV during family meals and dietary intake among adolescents. *J Nutr Educ Behav* **39(5)**: 257-263

Fernando GR, Martha RM, Evangelina R (1999). Consumption of soft drinks with phosphoric acid as a risk factor for the development of hypocalcemia in postmenopausal women. *J Clin Epidemiol* **52**: 1007-1010.

Flood JE, Roe LS, Rolls BJ (2006). The effect of increased beverage portion size on energy intake at a meal. *J Am Diet Assoc* **106**: 1984-1991.

Food Standards Australia New Zealand. Consumption of intense sweeteners in Australia and New Zealand - Roy Morgan Research Report. Canberra, Food Standards Australia New Zealand, 2003.

Goodman C, Anise A. What is known about the effectiveness of economic instruments to reduce consumption of foods high in saturated fats and other energy-dense foods for preventing and treating obesity? Copenhagen, WHO Regional Office for Europe, 2006.

Gordon R, McDermott L, Stead M, Angus K (2006). The effectiveness of social marketing interventions for health improvement: what's the evidence. *Public Health* **120**: 1133-1139.

Grimm GC, Harnack L, Story M (2004). Factors associated with soft drink consumption in school-aged children. *J Am Diet Assoc* **104**: 1244-1249.

Harnack L, Stang J, Story M (1999). Soft drink consumption among US children and adolescents: nutritional consequences. *J Am Diet Assoc* **99**: 436-441.

Hattersley L, Hector D. Building solutions for preventing childhood obesity. Module 1: Interventions to promote consumption of water and reduce consumption of sugary drinks. Sydney, NSW Cluster for Overweight and Obesity, 2008, vol 2007.

Hector D, Rangan A, Louie JCY, Flood V, Gill T. Soft drinks, weight status and health; a review. Sydney, Australia, NSW Cluster for Public Health Nutrition, 2008.

Hill AB (1965). The environment and disease: association or causation? *Proc R Soc Med* **58**: 295-300.

Jacobson MF. Liquid Candy: How Soft Drinks Are Harming Americans' Health. Washington, D.C., Center for Science in the Public Interest, 2005.

James J, Thomas P, Cavan D, Kerr D (2004). Preventing childhood obesity by reducing consumption of carbonated drinks: cluster randomised controlled trial. *BMJ (Clinical research ed)* **328**: 1237.

James P, Finer N, Lobstein T, Baillie K, Leach RJ, Scarrott F *et al.* Obesity in Europe - The case for action. London, European Association of the Study of Obesity, 2002.

Joint WHO/FAO Expert Consultation. Diet, Nutrition and the Prevention of Chronic Diseases. Geneva, WHO, 2003.

Juliano LM, Griffiths RR (2004). A critical review of caffeine withdrawal: empirical validation of symptoms and signs, incidence, severity, and associated features. *Psychopharmacology (Berl)* **176**: 1-29.

Kassem NO, Lee JW (2004). Understanding soft drink consumption among male adolescents using the theory of planned behavior. *J Behav Med* **27**: 273-296.

- Kelly B, Chapman K (2007). Food references and marketing to children in Australian magazines: a content analysis. *Health Promotion International* **22**: 284-290.
- Kim D, Kawachi I (2006). Food taxation and pricing strategies to "thin out" the obesity epidemic. *Am J Prev Med* **30**: 430-437.
- Kuchler F, Tegene A, Harris JM. Taxing snack foods: what to expect for diet and tax revenues. Washinton, D.C., Economic Research Service, US Department of Agriculture, 2004.
- Kynast-Gales SA, Massey LK (1994). Effect of caffeine on circadian excretion of urinary calcium and magnesium. *J Am Coll Nutr* **13**: 467-472.
- Laurence S, Peterken R, Burns C (2007). Fresh Kids: the efficacy of a Health Promoting Schools approach to increasing consumption of fruit and water in Australia. *Health Promotion International* **22**: 218-226.
- Lavin JH, French SJ, Read NW (1997). The effect of sucrose- and aspartame-sweetened drinks on energy intake, hunger and food choice of female, moderately restrained eaters. *Int J Obes Relat Metab Disord* **21**: 37-42.
- Levy G, Tapsell L (2007). Shifts in purchasing patterns of non-alcoholic, water-based beverages in Australia, 1997–2006. *Nutrition and Dietetics* **64**: 268-279.
- Lobstein T, Dobb S (2005). Evidence of a possible link between obesogenic food advertising and child overweight. *Obes Rev* **6**: 203-208.
- Loughridge JL, Barratt J (2005). Does the provision of cooled filtered water in secondary school cafeterias increase water drinking and decrease the purchase of soft drinks? *Journal of human nutrition and dietetics* **18**: 281-286.
- Louie JCY, Hector D, Rangan AM, Flood V, Gill T (2008). A comparison of two nutrition signposts for use in Australia. *N S W Public Health Bull* **In Press**.
- Ludwig DS, Peterson KE, Gortmaker SL (2001). Relation between consumption of sugar-sweetened drinks and childhood obesity: a prospective, observational analysis. *Lancet* **357**: 505-508.
- Lytle LA, Seifert S, Greenstein J, McGovern P (2000). How do children's eating patterns and food choices change over time? Results from a cohort study. *Am J Health Promot* **14**: 222-228.
- Ma D, Jones G (2004). Soft drink and milk consumption, physical activity, bone mass, and upper limb fractures in children: A population-based case-control study. *Calcif Tissue Int* **75**: 286-291.
- Malik VS, Schulze MB, Hu FB (2006). Intake of sugar-sweetened beverages and weight gain: a systematic review. *Am J Clin Nutr* **84**: 274-288.
- Matthiessen J, Fagt S, Biloft-Jensen A, Beck AM, Ovesen L (2003). Size makes a difference. *Public Health Nutrition* **6**: 65-72.
- May J, Waterhouse PJ (2003). Dental erosion and soft drinks: a qualitative assessment of knowledge, attitude and behaviour using focus groups of schoolchildren. A preliminary study. *Int J Paediatr Dent* **13**: 425-433.
- McGartland C, Robson PJ, Murray L, Cran G, Savage MJ, Watkins D *et al* (2003). Carbonated soft drink consumption and bone mineral density in adolescence: the Northern Ireland Young Hearts project. *J Bone Miner Res* **18**: 1563-1569.
- NHMRC. Dietary Guidelines for Children and Adolescents in Australia incorporating the Infant Feeding Guidelines for Health Workers. Canberra, NHMRC, 2003a, vol 2007.

NHMRC. Dietary Guidelines for Australian Adults. Canberra, NHMRC, 2003b, vol 2007.

Pereira MA (2006). The possible role of sugar-sweetened beverages in obesity etiology: a review of the evidence. *Int J Obes* **20**: S28-S36.

Petridou E, Karpathios T, Dessypris N, Simou E, Trichopoulos D (1997). The role of dairy products and non alcoholic beverages in bone fractures among schoolage children. *Scand J Soc Med* **25**: 119-125.

Phillips SM, Bandini LG, Naumova EN, Cyr H, Colclough S, Dietz WH *et al* (2004). Energy-dense snack food intake in adolescence: longitudinal relationship to weight and fatness. *Obes Res* **12**: 461-472.

Popkin BM, Armstrong L, Bray GM, Caballero B, Frei B, Willett WC (2006). A new proposed guidance system for beverage consumption in the United States. *Am J Clin Nutr*. **83**: 529-542.

Raben A, Vasilaras TH, Møller AC, Astrup A (2002). Sucrose compared with artificial sweeteners: different effects on ad libitum food intake and body weight after 10 wk of supplementation in overweight subjects. *Am J Clin Nutr* **76**: 721-729.

Rolls BJ, Roe LS, Meengs JS (2007). The effect of large portion sizes on energy intake is sustained for 11 days. *Obesity (Silver Spring)* **15**: 1535-1543.

Schulze MB, Manson JE, Ludwig DS, Colditz GA, Stampfer MJ, Willett WC *et al* (2004). Sugar-sweetened beverages, weight gain, and incidence of type 2 diabetes in young and middle-aged women. *The Journal of the American Medical Association* **292**: 927-934.

Smith A, Kellett E, Schmerlaib Y. The Australian guide to healthy eating: background information for nutrition educators. Canberra, Commonwealth Department of Health and Family Services, 1998.

Stookey JD, Constant F, Gardner CD, Popkin BM (2007). Replacing sweetened caloric beverages with drinking water is associated with lower energy intake. *Obesity (Silver Spring)* **15**: 3013-3022.

Striegel-Moore RH, Thompson D, Affenito SG, Franko DL, Obarzanek E, Barton BA *et al* (2006). Correlates of beverage intake in adolescent girls: the National Heart, Lung, and Blood Institute Growth and Health Study. *The Journal of Pediatrics* **148**: 183-187.

Swithers SE, Davidson TL (2008). A role for sweet taste: calorie predictive relations in energy regulation by rats. *Behav Neurosci* **122**: 161-173.

Taylor R, Scragg R, Quigley R. Do sugary drinks contribute to obesity in children? A report prepared by the Scientific Committee of the Agencies for Nutrition Action. New Zealand, 2005.

Thornley L, Quigley R, Watts C, Conland C, Meikle R, Ball J. Healthy Eating: Rapid Evidence Review of Nutrition Social Marketing Interventions to Prevent Obesity. Prepared for the Health Sponsorship Council. Wellington, New Zealand, Quigley and Watts Ltd, 2007, vol 2007.

Tordoff MG, Alleva AM (1990). Effect of drinking soda sweetened with aspartame or high-fructose corn syrup on food intake and body weight. *Am J Clin Nutr* **51**: 963-969.

Tucker KL, Morita K, Qiao N, Hannan MT, Cupples LA, Kiel DP (2006). Colas, but not other carbonated beverages, are associated with low bone mineral density in older women: The Framingham Osteoporosis Study. *Am J Clin Nutr* **84**: 936-942.

van der Horst K, Kremers S, Ferreira I, Singh A, Oenema A, Brug J (2007). Perceived parenting style and practices and the consumption of sugar-sweetened beverages by adolescents. *Health Educ Res* **22**: 295-304.

Vartanian LR, Schwartz MB, Brownell KD (2007). Effects of soft drink consumption on nutrition and health: a systematic review and meta-analysis. *Am J Public Health* **97**: 667-675.

Vereecken CA, Keukelier E, Maes L (2004). Influence of mother's educational level on food parenting practices and food habits of young children. *Appetite* **43**: 93-103.

Webb KL, Lahti-Koski M, Rutishauser I, Hector DJ, Knezevic N, Gill T *et al* (2006). Consumption of 'extra' foods (energy-dense, nutrient-poor) among children aged 16–24 months from western Sydney, Australia. *Public Health Nutrition* **9**: 1035-1044.

Wilde A, Gill T, Swinburn B, On behalf of The Communication on Obesity Action for Child Health (COACH) Reference Group. Effective Communication on childhood obesity prevention by non-government organisations and agencies. PHASE 1. Developing consistent, clear and evidence-based messages. Sydney, ASSO, 2007.

Wilson LF (2007). Adolescents' attitudes about obesity and what they want in obesity prevention programs. *The Journal of School Nursing* **23**: 229-238.

Wolf A, Bray GA, Popkin BM (2008). A short history of beverages and how our body treats them. *Obesity Reviews* **9**: 151-164.

World Health Organization Europe. The challenge of obesity in the WHO European Region and the strategies for response; in: Francesco Branca, Nikogosian H, Lobstein T (eds). Copenhagen, WHO Europe, 2007.

Wu KL, Chaikomin R, Doran S, Jones KL, Horowitz M, Rayner CK (2006). Artificially sweetened versus regular mixers increase gastric emptying and alcohol absorption. *Am J Med* **119**: 802-804.

Wyshak G (2000). Teenaged girls, carbonated beverage consumption, and bone fractures. *Arch Pediatr Adolesc Med* **154**: 610-613.

Young LR, Nestle M (2002). The contribution of expanding portion sizes to the US obesity epidemic. *Am J Public Health* **92**: 246-249.