

# Tap into Good Teeth – a Western Australian pilot study of children's drinking patterns

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## Introduction

Fluoridated water has been one of the more successful 20<sup>th</sup> century public health initiatives and one of the most effective population level approaches to control caries currently in place in Australia.<sup>1,2</sup> The introduction of fluoridated water is estimated to have reduced dental caries by 20–40%,<sup>3</sup> although there is now a trend towards an increase in the prevalence of dental caries in Australian children.<sup>4</sup>

Dental caries in Australian children declined between the late 1970s and the late 1990s, with the average decayed, missing and filled deciduous teeth (DMFT) decreasing from more than three DMFT in 1977 to 0.89 DMFT in 1998 for 6-year old children. Since 1998, the six year old DMFT has increased by 24% and almost 15% in 12-year old children.<sup>5,6</sup> There are a number of possible explanations for this increase, including artefacts of data, issues with access to school dental services, a shift to low fluoride toothpaste in younger children, increased consumption of non-fluoridated commercial bottled water and manufactured soft drink consumption.<sup>1</sup> In addition, refined sugar is an important contributor to dietary intake of energy in Australian children.<sup>1,7</sup> The increased energy consumed by children potentially increases caries risk and other childhood diseases such as obesity and type 2 diabetes.<sup>8</sup>

Contemporary patterns of both food and drink consumption have also changed in Australian adults and children over the last 10

years.<sup>9–11</sup> Bottled water has become an accepted water source and is popular amongst adults and children.<sup>12–14</sup> In 1994, purchased bottled water was consumed by 3% of Australian households increasing to 21% by 2004.<sup>15</sup> Busy lifestyles and the widespread availability of bottled water and other drinks outside the home have raised concerns in Australia and in the US around the diminished dental health benefits of non-fluoridated bottled water substituted for fluoridated tap water.<sup>3,16,17</sup>

Since the 1960s there has been considerable research into water quality perception, although the processes underlying the perception of drinking water quality are still not fully understood.<sup>18</sup> A recent UK review of factors influencing public perception of drinking water found taste as the key issue for choice for drinking water<sup>6,18,19</sup> with similar results in the US and Canada.<sup>19</sup> Few studies have examined parents attitudes with young children towards water quality and how this affects their drinking choices.<sup>19</sup> Parental style, beliefs, attitudes and perceptions about water, such as taste, smell, colour, safety, cost, and convenience may affect decisions about their child's water consumption.<sup>19,20</sup> Merkel et al. recently reported high overall parental attitudes towards tap water quality and safety, and a preference for tap water over bottled water.<sup>19</sup>

The Tap into Good Teeth study was pilot research into children's drinking patterns conducted in Western Australia in 2008. The paper

## Abstract

**Issued addressed:** The increase trend in the prevalence of dental caries in Australian children is a concern to public health professionals. Attitudes, behaviours and lifestyle patterns established in childhood are often carried throughout adult life. The objective of the study was to estimate the proportion of Perth metropolitan year two public primary school children drinking tap water at home, school and play. It also aimed to explore knowledge and attitudes that children and parents have towards drinking tap water, bottled water, fruit juices and soft drinks.

**Methods:** Nine Western Australian government primary schools were recruited. A facilitator-led questionnaire was administered to year two primary school students and a matched parent self-administered questionnaire was also completed.

**Results:** Forty-two per cent of the children in our study reported if thirsty they drank tap (fluoridated) water at home whereas parents stated 60% of children drank tap water at home. The type of drink appeared to vary with time of day/activity while overall water was most frequently drunk; a higher proportion of milk was drunk at breakfast, whereas soft drinks were drunk in a greater proportion while watching television.

**Conclusion:** This study found the vast majority of year two children in metropolitan Perth public primary schools are drinking tap water.

**Key words:** children, dental caries, fluoridated water, drinking water

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## So what?

Further research into the contribution of carbonated soft drinks and sports drinks to the increased dental caries rate in young children is warranted.

presents the prevalence of drinking bottled water amongst grade two primary school children in metropolitan Perth, Western Australia (WA) and explores the perceptions and attitudes of parents and their children towards drinking tap water, bottled water and other fluids.

## Methods

### Research design and sampling

The Perth metropolitan region public drinking-water supply has been fluoridated since 1968,<sup>21</sup> so the primary school selection was accordingly limited to this region. The postal code of all primary schools in the Perth metropolitan region was used to assign a Socioeconomic Index for Areas (SEIFA) disadvantage score. The 2006 Western Australian census population SEIFA disadvantage score tertile cut-offs were used to group schools into low, medium and high socio-economic index (SEI) groups (area based). A random selection of schools was made using the random number generator function in Microsoft Excel. The first 10 schools from each group (i.e. low, medium and high SEI) were invited to participate. A letter of invitation, a consent form and a supporting letter from the Western Australian Department of Education and Training (DET) was sent to the principal of each school who was asked for consent to approach year two classes. Of 30 schools approached, 12 principals consented to their school's participation. Due to funding limitations nine schools were included in the study. Two schools were from high SEI, four from medium and three from low. All year two classes in a primary school were included in the study. A letter of invitation to participate in the study, a consent form and a parent information brochure were sent home with each year two child. The overall number of invited child/parent dyads was 275. The final number of parents who consented on behalf of their children was 104; and 94 parents who consented completed the survey. The response rates achieved was 37.8% for children and 80.3% for parents.

### Survey measures

Data were derived from year 2 metropolitan primary school children who participated in a facilitator-led group interview during school term three July-September, 2008. The rationale was that year 2 children are experiencing the eruption of their permanent dentition, and it was deemed an age-appropriate time to explore their drinking patterns. Two interviewers attended each classroom at a pre-arranged time. Each child for whom parental consent had been previously obtained was given an A4 activity workbook that contained a 25-item survey (a sample activity workbook page is shown in Figure 1). One facilitator read out each question to the group of children, and each child was required to complete their own survey by circling the most appropriate response to each question. Graphics and symbols were used to help the children choose the most appropriate response. Practice questions were completed prior to data collection to familiarise the children with the process. Each classroom interview took approximately 60 minutes to complete. At the completion of all questions being read out and responses recorded, the workbooks were collected and the data were entered into SPSS.

Children were asked questions about their dental hygiene, e.g. "How often do you usually brush your teeth?" with response categories – 'once a day', 'twice a day', 'I don't know'. Meal time fluid consumption was

asked "What did you have to drink at breakfast yesterday", with the option replaced for 'dinner', 'playing sport', 'watching TV' and 'special occasions'. Children could respond by circling a wide range of categories including 'milk', 'flavoured milk', 'juice', 'water', 'cordial', 'soft drink' and 'I don't know'. Children were asked "At home if you want a drink of water, where do you get your water from?" with response categories – 'the tap or tap water that has been made cold in the fridge', 'bottled water from the supermarket', 'from a water filter that is on the tap or in a jug in the fridge', or 'I don't know'. Children were asked "If you couldn't have water to drink what would you choose next?" with response categories 'milk – juice', 'cordial', 'soft drink' and 'I don't know'. Children were asked "Why would you choose these?" with response categories – 'tastes the best', 'it is healthier', 'because my friends drink it', 'I saw it on a TV ad' and 'I don't know'. Survey items were developed by the research team, due to limited existing items, and pilot tested at one low SEI primary school. As a result of the pilot survey the questionnaire was shortened and visual prompts, e.g. an empty milk carton, juice container, were removed.

The self-administered parent survey comprised 20 questions. Briefly, parents were asked their child's meal time fluid consumption – "What does your child drink at the following times of the day?" options being 'breakfast', 'morning tea', 'lunch', 'afternoon tea', 'dinner' and 'after dinner'. With the response categories 'milk', 'flavoured milk', 'juice', 'water', 'cordial', 'soft drink', 'nothing' and 'I don't know'. Knowledge and attitudes towards the source of drinking water and other fluids was also asked using a strongly agree – strongly disagree 5 point-Likert scale e.g. "It is difficult to get children to drink fluids with little flavour"; "The only water my kids prefer to drink is either filtered or bottled water"; "Tap water tastes bad"; and "Bottled/filtered water is better for your health".

Ethics approval was granted for the Tap into Good Teeth research from both the University of Western Australia Human Research Ethics Committee and the Western Australian Department of Education and Training (DET) Ethics approval committee. Active, written consent was obtained from the principals and the parents for both themselves and their child. DET also requested that we gain oral active consent from the children.

**Figure 1: Tap into Good Teeth Workbook page example.**

**7) What did you have to drink for breakfast yesterday?**  
You can circle more than one drink.



## Statistical analysis

Quantitative data from the year two facilitator-led questionnaire and parent self-administered questionnaire were entered into and analysed using SPSS (version 15.0). Data are presented as percentages for the categorical variables. Cross tabulations were also generated using SPSS version 15.0. The analysis was completed in January 2009.

## Results

When year two primary school children were asked what they had to drink with their breakfast, lunch and dinner the day before the survey, children identified water as the most commonly consumed drink at lunch, dinner and overall, with milk the most commonly-consumed drink at breakfast (see Table 1). If children consumed more than one type of drink with their meal, the most common combinations were milk and water (26%); juice/cordial and water (22%); soft drink and water (9%); and milk and juice/cordial (9%).

Ninety-four parents completed the questionnaire of whom 68% were the child's mother. The age range of the parents was: 20-29 years (5.3%); 30-39 years (45.3%); 40-49 years (43.2%); and 6.3% did not state their age. Almost two-thirds were from medium to high SEI (30.5% and 25.0% respectively) and just less than one-quarter were from low SEI (23.1%). SEI data was missing for 13.5%. Thirty-two per cent

stated housewife as their profession followed by clerical staff (11%).

Parents were asked the same questions as their child regarding what the child drank at breakfast, lunch and dinner. Overall, both the parents and children reported milk as contributing to almost 20% of their total fluid consumption (18.9% and 18.1% respectively) the day before the survey. Parents reported more water consumed at lunch than the children (70.0% versus 49.6% respectively) and less flavoured milk (3.3%) compared to the child response which was almost three times higher (9.7%). Furthermore, children reported almost twice the contribution of soft drinks (8.6%) to their total daily intake compared to the parent response (4.7%). The responses are shown as percentages in Table 1.

Children were also asked what drinks they consumed at morning and afternoon tea, when they exercised, and when they watched television. Just fewer than 50% drank water at morning tea and afternoon tea (44% and 47% respectively). The most common drinks during sport or exercise were water (59%) and sports drinks (25%). The most common drinks while watching television were water (25%), juice/cordial (25%) and soft drink (16%) (see Table 2).

When asked "If you could not have water to drink what would you choose next?", 46% of children chose fruit juice/cordial, 39% chose milk, and 28% soft drink (see Table 3). When asked "why they chose that drink?" 75% of those who said soft drink and 42% of those who said fruit juice/cordial determined their choice by taste. For those who said milk, the majority of children (78%) said health was the most important factor. Peer influence and television advertising were also factors when choosing soft drink at 14% and 21% respectively (see Table 3).

Within the home, 42% of children said that if they wanted a drink of water they would get it from the tap, or drink tap water that had been cooled in the fridge, with 29% drinking bottled water from the supermarket and 29% drinking filtered water from a tap or a jug in the fridge. Compared with children, a greater proportion of parents (60%) reported the most common water source as the tap, or tap water either refrigerated or straight from the tap. Water from a filter that is on the tap or in a jug in the fridge was the source of water according to 32% of parents, with 8% bottled water from the supermarket. Within the school environment, among the 38% of children who refilled their drink bottle at school, 41% did so because they were thirsty, 34% had just been playing sport, a game or exercising, with 10% refilling their drink bottle to get out of class.

**Table 1: Children and parent responses to drinks consumed at breakfast, lunch and dinner (%).**

	Breakfast % (n)*	Lunch % (n)*	Dinner % (n)*	Total %
<b>Children</b>				
Water	30.8% (45)	49.6% (56)	38.8% (52)	38.9%
Milk	37.0% (54)	.9% (1)	11.9% (16)	18.1%
Flavoured milk	4.1% (6)	9.7% (11)	1.5% (2)	4.8%
Juice/cordial	14.4% (21)	22.1% (25)	24.6% (33)	20.1%
Soft drink	5.5% (8)	4.4% (5)	15.7% (21)	8.6%
Unsure	12.0% (12)	13.3% (15)	7.5% (10)	9.5%
<b>Parents</b>				
Water	30.4% (51)	70.0% (84)	53.3% (72)	48.9%
Milk	36.3% (61)	2.5% (3)	11.9% (16)	18.9%
Flavoured milk	9.5% (16)	3.3% (4)	0.7% (1)	5.0%
Juice/cordial	20.2% (34)	17.5% (21)	23.0% (31)	20.3%
Soft drink	0.6% (1)	4.2% (5)	15.7% (21)	4.7%
Unsure	3.0% (5)	2.5% (3)	0.7% (11)	2.1%

\*Children and/or parents could choose more than one drink choice at meal times

**Table 2: Drinks reported to be consumed by children at morning and afternoon tea, watching TV and playing sport (%).**

	Morning tea % (n)*	Afternoon tea % (n)*	Watching TV % (n)*	Playing sport % (n)*	Total %
Water	43.8% (49)	46.7% (57)	25.2% (34)	59.3% (80)	43.3%
Milk	8.0% (9)	4.1% (5)	8.1% (11)	5.2% (7)	7.1%
Flavoured milk	6.3% (7)	4.1% (5)	3.0% (4)	0.7% (1)	3.3%
Juice/cordial	17.0% (19)	24.6% (30)	24.6% (33)	4.4% (6)	16.7%
Soft drink	1.8% (2)	4.9% (6)	16.3% (21)	2.2% (3)	6.5%
Sport drink	DNA	DNA	6.7% (9)	25.2% (34)	8.5%
Unsure	23.2% (26)	15.6 (19)	7.5% (10)	3.0% (4)	14.6%

\*Children could choose more than one drink choice at meal times

DNA – did not ask

**Table 3: Drinks reported by children if water is not available and the reasons for making that drink choice (%).**

Drink Choice	% (n=104)*	Reason why? (%)
Fruit juice/cordial	46.1 % (48)	Tastes the best (42%) It is more healthy (33%) Because my friends drink it (8%) I saw it on a TV ad (10%)
Milk	39.4% (41)	Tastes the best (21%) It is more healthy (78%) Because my friends drink it (5%) I saw it on a TV ad (7%)
Soft drink	27.9% (29)	Tastes the best (75%) It is more healthy (14%) Because my friends drink it (14%) I saw it on a TV ad (21%)

\*Children could choose more than one drink

The majority of children (77%) think tap water is a healthy drink choice, with 13% believing it unhealthy and 10% who did not know. When asked why they thought tap water was healthy, 70% said it was because 'Mum or Dad says so', with 30% believing it healthy because 'it tastes different'. When investigating parents' attitudes towards tap water and other fluids almost one-quarter (24%) of parents agreed with the statement 'bottled/filter water is better for your health' and 21% agreed with the statement 'tap water tastes bad'. Fourteen per cent of parents agreed with the statements 'it was difficult to get your child to drink fluids with little flavour' and 'the only water my child prefers to drink is filtered or bottled water'.

## Discussion

The Tap into Good Teeth pilot study found that 42% of the primary school children drank fluoridated tap water, with 60% of parents stating children drank tap water at home when they wanted a drink. Children and parents reported different amounts of bottled water purchased from the supermarket (29% versus 8% respectively). The higher consumption of purchased water reported by children compared with parents may be partly because primary school children have difficulty discerning whether a commercial bottle of water was a new non-fluoridated water source or had been refilled by the parent using tap water. In contrast, the study found 29% of children drank water from a filter that is on the tap or in a jug in the fridge, while 32% of parents gave the same answer. The filtered water finding is consistent with Australian Bureau of Statistics (ABS) (2005) research which reported households in South Australia 30%, Western Australia 29% and Queensland 27% were more likely to use water filters for drinking water.<sup>22</sup>

Overall, this study found that water was the most popular drink at breakfast, lunch and dinner (39%), followed by juice/cordial (20%) and milk (18%). Water is also clearly the most common drink for morning and afternoon tea. The proportion of children drinking sweetened drinks was greater during periods when children may be unsupervised by a parent or carer including morning tea, afternoon tea and while watching television. Soft drink increased to 16% at these times compared with 8% at breakfast, lunch and dinner. Recently, it has been reported that contemporary fluid consumption patterns of children are now more diverse, as carbonated soft

drinks, fruit juices and noncarbonated sports drinks have replaced the previous consumption of water and milk among children.<sup>23,24</sup> The novel finding in this study is the reported consumption of sports drinks by seven-year-olds when playing sport, but also when watching TV. This requires further investigation. The nutrition transition to higher intakes and frequency of free sugars, in which the major source is soft drinks and sports drinks, may result in increased dental caries.<sup>11,25</sup> We suggest further examination of the pattern and contribution of carbonated soft drinks and other energy-dense fluids including sport drinks, together with the fluoride intake and oral hygiene practices of Australian children, is warranted.

Children are influenced by taste, healthy choices, family, peers and television advertising when choosing a substitute for water.<sup>26</sup> Television advertising has attracted much attention for its potential role in promoting unhealthy food and drink choices to children.<sup>27-29</sup> However, the role of peers is an emerging and interesting finding in this study. Earlier research around fruit and vegetable choices in young children found a significant shift from children choosing their preferred food on day 1 to choosing their non-preferred food by day 4, after observing their peer choices.<sup>30</sup> Cullen et al. also found parental modelling and peer normative beliefs were significantly correlated with fruit and vegetable consumption.<sup>26</sup> Furthermore, younger children appear to be more affected by peer modelling than older children when it comes to food and drink choices.<sup>20,30</sup> Peers may potentially be one of the most influential factors for influencing healthy drink choices,<sup>31</sup> and there is a need to further investigate how we may use this to influence dietary behaviour in younger children.

One of the roles of parents is to introduce children to a variety of tastes in food and drink choices at a young age so that they may develop the knowledge and skills to ascertain what is optimal for promoting their dental health and a range of other health issues.<sup>20,32,33</sup> In addition, environmental supports such as providing clean, easily accessible cold water, self-serve drinking fountains and bubblers in a variety of settings such as schools, after-school care and junior sporting clubs are important enablers. Furthermore, a health-promoting schools approach towards oral health promotion, where sugary drinks and snacks are banned and oral hygiene education is part of the curriculum, are potential environmental supports that may promote drinking tap water and, more broadly, oral health promotion.<sup>34</sup>

Our results found one-fifth of parent respondents agreed with the statement 'Tap water tasted bad'. These results concur with findings of the ABS, 2005, with the proportion of people satisfied with the quality of mains water for drinking increasing from 66% in 2001 to 70% in 2004.<sup>35</sup> Of interest, the water supply across Perth is an integrated water supply system that draws on surface sources, groundwater and desalinated sea-water. Households in the study may have received a mix of all three; with the percentage of each depending on seasonal factors, and variations in taste may have occurred. The literature suggests that popular attitudes towards the replacing of tap water with bottled water by adults include: a raised health consciousness as bottled waters were depicted as 'healthy alternatives' to other beverages; advertising that endorses bottled water as 'tasty', 'fresh', 'pure'; and perceived questionable quality of public water, with regard to taste, colour and odour.<sup>3,12,36</sup> As such, bottled water is seen as a healthy alternative, not only to sweetened



drinks but increasingly as an alternative to tap water.<sup>3</sup> The literature on parental attitudes is limited, however, our findings provide some insight around health and taste attitudes that exist among parents of year 2 primary school children in metropolitan Perth, WA. The opportunity to increase parent awareness of the benefits of tap water, to counteract anecdotal reports linking bottled water with increased dental decay and promote the well-documented preventative effects of fluoride<sup>37,38</sup> are recommended and timely.

The Tap into Good Teeth research methodology has a number of limitations which must be considered when interpreting the results. The study is limited by the small number of schools and parents, and conducted among year 2 Perth metropolitan primary school children, reducing the generalisability of this study. Letters of invitation to participate in the study were sent home with the children and may account for low response rates, in addition, the school setting is often used for data collection and parents may have been reluctant to undertake further research. Undertaking research with school children was challenging and several factors needed to be considered to maximise the quality of data obtained. First, it was important to develop a sense of enthusiasm within the classroom and to foster a child-centred approach. Another important factor was classroom management. The researchers recognised that having a small, manageable class size, a teacher present and a discipline plan in place improved the response rate of the children. Relying on self-report among young children and parents also has limitations including socially desirable responses regarding the consumption of water, sweetened drinks and other fluids. Finally, the questionnaire itself was too long.

## Conclusion

The recent trend towards an increase in the prevalence of dental decay in Australian children raises the question about the amount of fluoridated tap water children are drinking. This study found the vast majority of year two children in metropolitan Perth public primary schools are drinking tap water. It is of interest that water is clearly the most common drink for morning and afternoon tea, however watching TV has a different pattern which needs to be further explored. Parents do not perceive bottled/filtered water as a healthier alternative to tap water. Recommendations would include guidelines and practical strategies to promote and reinforce the benefits of drinking tap water to parents and children. However, what remains unclear is (i) the amount of tap water children are drinking; and (ii) the contribution of carbonated soft drinks, fruit juices and sports drinks to the increased dental caries rate. This research raises questions particularly around: how tap water can be promoted to children and parents; the role of peers in making food and drink choices; and the attitudes of parents with young children towards water quality and how this affects their drinking choices. Further research is required to answer these questions fully.

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