



## Fruit Juice Nutrition and Health

# Findings from the 2007 Australian National Children's Nutrition and Physical Activity Survey

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### THE 2007 CHILDREN'S SURVEY REVEALED THAT FRUIT JUICE:

- Markedly increased the number of children meeting their fruit serves
- Provided the same total energy (2%) on average in 2007 as 1995
- Intake is 112ml on average – within the serve recommendations of the Government's Australian Guide to Healthy Eating
- Is associated with dietary positives – less fat and saturated fat, more folate, potassium and vitamin C than those not consuming juice
- Is most often consumed with meals and mid meals
- Contributes a range of important nutrients to the diet
- Does not compromise fibre or calcium intakes.



**IN AUGUST 2006, A POSITION PAPER FOR HEALTH PROFESSIONALS "FRUIT JUICE NUTRITION AND HEALTH – A REVIEW" WAS DEVELOPED AND DISTRIBUTED TO KEY HEALTH PROFESSIONAL GROUPS AND RELEVANT HEALTH AGENCIES BY THE AUSTRALIAN FRUIT JUICE ASSOCIATION.**

Independently reviewed by Professor Katrine Baghurst, the report was well received as it provided new information on the dietary intake and nutritional contribution of fruit juice via a CSIRO analysis of the 1995 National Nutrition Survey which included both adults and children. The report also contained the latest scientific information on the role of fruit juice in health.

Since that time, the responsibilities of the Australian Fruit Juice Association have been incorporated into Fruit Juice Australia a division of the Australian Beverages Council Ltd. (ABCL). In addition, the 2007 Australian National Children's Nutrition and Physical Activity Survey (subsequently referred to as the "2007 Children's Survey") has been completed providing new National dietary intake information for children for the first time in over a decade.

Fruit Juice Australia in conjunction with ABCL agreed that it would be of value to health professionals, Government and the industry to undertake a similar analysis of the 2007 children's diet survey.

**Analysing the 2007 Children's Survey**

The analysis of the 2007 Children's Survey was conducted by Flinders Partners, a wholly owned subsidiary of Flinders University on behalf of Fruit Juice Australia. Flinders Partners specifically investigated fruit and fruit juice consumption patterns in Australian children<sup>1</sup>.

The Flinders analysis also considered the relationship between fruit juice intake and diet quality along with when juice was consumed. Key findings of the analysis are included in this report. Unless otherwise stated, facts concerning fruit juice intake in Australian children have been sourced from the Flinders University analysis.

**Comparing 1995 Nutrition Survey findings with 2007 Children's Survey data**

The 2001 CSIRO analysis of the 1995 National Nutrition Survey provided much of the data for the original fruit juice nutrition and health review. Particular emphasis was therefore given when analysing the 2007 Children's survey to replicating key elements of the methodology of the CSIRO analysis. As such, it is possible to compare key aspects of fruit juice intake in children across a significant time span from 1995 to 2007 - providing a unique insight to fruit juice consumption and its contribution to the diet over time.

It is acknowledged that there were some methodological differences in overall survey design and data collection methods between the 1995 National Nutrition Survey and the 2007 Children's Survey which have been taken into account.

**KEY FINDING**

**ENERGY CONTRIBUTION OF FRUIT JUICE 1995 VERSUS 2007**

In the period since the 1995 nutrition survey, significant attention has been paid to childhood bodyweight with concerns that excess energy intake from a variety of sources may be contributing to childhood overweight and obesity.

As such, it was of particular interest to investigate the energy contribution of fruit juice across the two surveys.

The analysis concluded:

**"Fruit juice contributed 2% to total energy intake for both the children aged 2-18 years in 1995 and also for the children aged 2-16 years in the 2007 survey<sup>1</sup>"**

As such, the average energy contributed by juice has remained the same between the 1995 and 2007 survey. This is clearly an important finding as it

provides national evidence that the average amount of energy provided by fruit juice has not changed in the last 12 years.

By comparison, fruit alone provided a slightly higher percentage of total energy intake in 2007 (5% for those aged 2-16 years) compared to the results from the 1995 survey (3% for those aged 2-18 years).



## Healthy Bodyweight - The Weight of Evidence

Two recent publications which considered fruit juice and bodyweight, found no association between fruit juice consumption and weight status.

In the first investigation (which also looked at fruit juice drinks as well as fruit juice) involving 1,572 children aged 2-5 years in the US, no association between juice intake and weight was found<sup>3</sup>.

The second was a paper that assessed 9 cross sectional and 12 longitudinal studies that had investigated juice intake and body weight. In this analysis, not only was there no association found between fruit juice and weight status (or the likelihood of being overweight), juice consumers also had better nutrients intakes<sup>4</sup>. The authors concluded:

**“Based on the currently available evidence, it can be concluded that there is no systematic association between consumption of 100% fruit juice and overweight in children and adolescents <sup>4</sup>.”**

In terms of the scientific evidence relating to fruit juice and body weight, the review identified a total of 15 studies (9 longitudinal and 6 cross sectional) where no association was found. Five of these studies were based on nationally representative samples<sup>4</sup>.

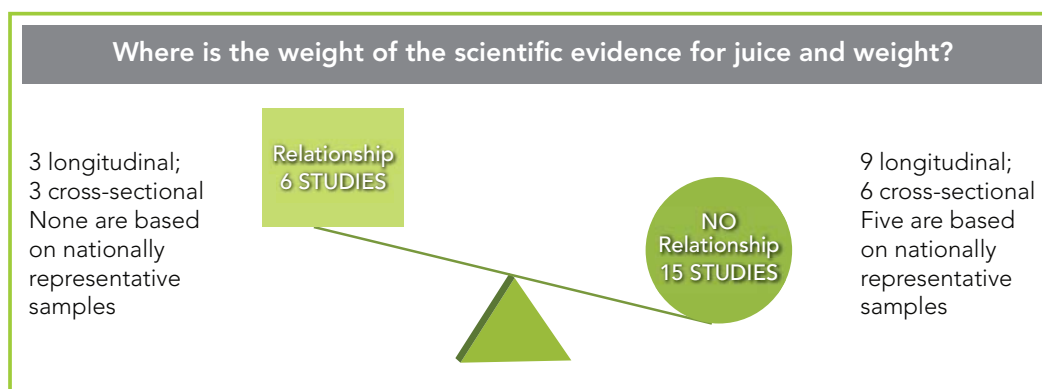
Of the six studies indicating a relationship existed between fruit juice and bodyweight, none were based on nationally representative samples<sup>4</sup>.

The considerable difficulty in reaching a clear understanding on the relationship between beverages and body weight status has recently been highlighted by Drewnowski and Bellisle<sup>5</sup>.

They concluded that complexities associated with beverage intake and body weight highlighted the need to consider not only physiological factors but also psychological aspects of beverage consumption and weight status<sup>5</sup>. Indeed, they also questioned the common belief that liquid calories fail to trigger satiety mechanisms and suggested the evidence in this regard should be considered inconclusive<sup>5</sup>.

Fructose has recently been implicated in weight gain. A recent review of the evidence on fructose and body weight suggest the data is limited and contradictory with most focused on high fructose corn syrups which should not be confused with naturally occurring fructose<sup>6</sup>.

Of course, like any food or beverage category, the message for fruit juice intake is one of sensible consumption that takes into account age, gender as well as physical activity levels. However, the evidence currently favours no link between fruit juice and weight gain.



Source: O'Neill & Nicklas 2008.

### FAST FACT

#### TOTAL ENERGY

Children\* consuming fruit juice had less total energy in the diet in 2007 (8,330kJ) than in 1995 (8,526kJ).

\*All children 2-16 years.



# KEY FINDING

## FRUIT JUICE AND ITS CONTRIBUTION TO FRUIT SERVES

The 2007 Children’s Survey demonstrated a low level of observance of the Dietary Guidelines for Children and Adolescents<sup>7</sup>.

Fruit intake was found to be below recommended levels generally and very low in some segments. The Flinders analysis clearly showed the important role fruit juice plays in helping children meet their fruit serve recommendations the report states:

“Only 1% of the older children aged 14-16 years consumed the recommended amounts (of fruit). When fruit juice was included as a ‘fruit serve’ (as is consistent with the Australian Guide to Healthy Eating), 24% of these 14-16 year olds now reported eating the recommended number of serves of fruits<sup>1</sup>.”

In each age segment (see figures 1-4 below) fruit juice makes a major contribution to achieving the recommended fruit serves. This finding is particularly relevant given the up-coming review of the Australian Guide to Healthy Eating<sup>8</sup>, which currently includes a serving of fruit juice (125 ml) as part of the total fruit serves.

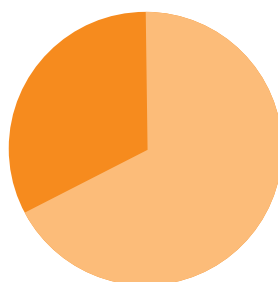
*The findings of the 2007 Children’s survey supports the retention of fruit juice within the fruit serving advice of a revised Australian Guide to Healthy Eating.*



**Figure 1:** Percentage of all 2-3 year old children meeting fruit serves with or without fruit juice.

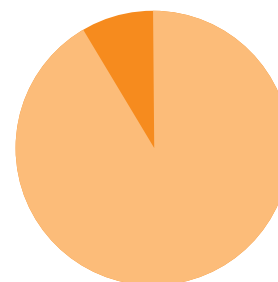
- Met recommendation
- Did not meet recommendation

### Without fruit juice



2-3 year olds meeting fruit serve recommendation\* without juice: **68%**

### With fruit juice



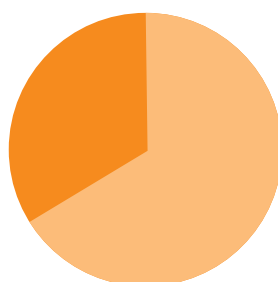
2-3 year olds meeting fruit serve recommendation\* with juice: **90%**

\*As there is no recommended number of fruit serves for children 2-3 years, the data above includes the percentage of young children who consumed at least one serve of fruit.

**Figure 2:** Percentage of all 4-8 year old children meeting fruit serves with or without fruit juice.

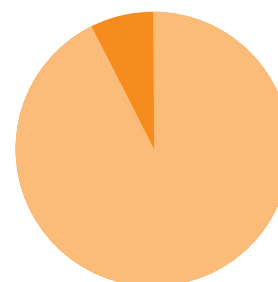
- Met recommendation
- Did not meet recommendation

### Without fruit juice



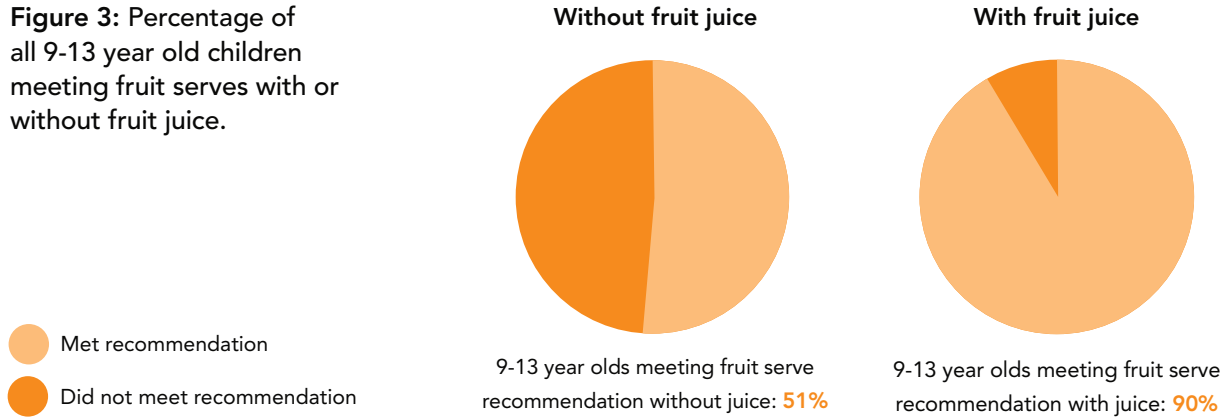
4-8 year olds meeting fruit serve recommendation without juice: **61%**

### With fruit juice



4-8 year olds meeting fruit serve recommendation with juice: **93%**

**Figure 3:** Percentage of all 9-13 year old children meeting fruit serves with or without fruit juice.



**Figure 4:** Percentage of all 14-16 year old children meeting fruit serves with or without fruit juice.



### WHAT IS FRUIT JUICE?

Accuracy when considering beverage consumption is important. In this regard the American Beverage Guidelines<sup>29</sup> make a clear distinction between sweetened beverages and fruit/vegetable juices.

**Sweetened Beverages:** Any beverage to which a caloric sweetener has been added, including carbonated or noncarbonated soft drinks, fruit punch, fruit drinks, lemonade, sweetened powder drinks, or any other nonartificially sweetened

beverages. Excluded from this definition are sugars naturally present in fluids and that are not added in processing, in preparation, or at the table.

**Fruit and Vegetable Juices:** Beverages that are composed exclusively of an aqueous liquid or liquids extracted from one or more fruits or vegetables with no added caloric sweeteners. This is often referred to as 100% juice.

### FAST FACT

#### FIBRE INTAKE

Optimising total fibre intake is often cited as a reason to limit fruit juice. However, the 2007 Children's survey showed there was no difference in total fibre intake between those consuming juice and those not consuming juice<sup>1</sup>.





## Fruit Juice and the Australian Guide to Healthy Eating

Currently the Australian Guide to Healthy Eating states that fruit juice (125 ml) can contribute to the total recommended fruit servings due to the high degree of nutritional congruence between 100% fruit juice and their whole food counterparts<sup>9</sup>.

Table 1 below reveals that fruit juice and whole fruit do not differ markedly in both total energy and sugars as well as a number

of other nutrients (apart from dietary fibre), supporting the advice in the current and any future healthy eating guide, that fruit juice be considered as a fruit serve.

Both the USA<sup>10</sup> and Canada<sup>11</sup> have retained a serve of fruit juice within their respective national fruit serve recommendations. However, in the US there has been a change in the equivalency for fruit juice (see below) that may have implications for the proposed review of the Australian Guide to Healthy Eating in Australia.

Table 1.

### Nutrient Comparison of popular whole fruit and the fruit juice counterpart per 100g<sup>9</sup>

Product	Water (g)	Energy (kj)	Avail Carb (g)	Sugars (g)	Fibre (g)	Beta Carotene Eq (ug)	Vit C (mg)	Folate (ug)	Calcium (mg)	Potassium (mg)
Orange <sup>a</sup>	85.3	185	9.0	9.0	2.1	75	50	N/a	29	170
Orange Juice <sup>c</sup>	89.7	148	8.2	7.9	0.1	93	49	40	8	156
Pineapple <sup>a</sup>	86.8	178	8.2	8.2	1.8	21	17	N/a	20	151
Pineapple Juice	88	183	10.3	10.3	-	11	12	8	6	143
Grapefruit <sup>a</sup>	88.3	138	5.4	5.4	1.7	14	40	14	24	135
Grapefruit Juice <sup>d</sup>	91.4	120	6.0	6.0	-	-	61	5	9	100
Grape <sup>b</sup>	79.6	284	15.5	15.5	2.4	108	5	-	14	221
Grape Juice	85.5	221	13.4	13.4	-	-	24	2	8	85
Apple <sup>b</sup>	83.8	236	12.8	12.4	2.2	14	6	-	5	106
Apple Juice <sup>e</sup>	88.9	167	10.1	10.1	-	4	45	4	4	84

a = raw peeled ; b = unpeeled raw ; c = sweetened, added vit c ; d = white grapes ; e = added vit c  
NUTTAB 2006, 100 gram edible portions.

### ENERGY EQUIVALENCY FOR FRUIT JUICE AS A FRUIT SERVE

The Dietary Guidelines Advisory Council in the US undertook an analysis<sup>12</sup> of the nutrient profile of diets with and without the inclusion of pure fruit juices as part of the diet modelling for My Pyramid and found:

“The nutrient profile for whole fruit only without 100% fruit juice was substantially lower in vitamin C, folate, potassium and calories than the fruit plus juice nutrient profile. It was notably higher in fiber and vitamin A”.

**As a result of this analysis the US now has a ‘cup’ of fruit juice as equivalent to a ‘cup’ of fruit (where a cup is defined as equivalent to one large orange, one medium apple etc which aligns with one of Australia’s ‘fruit serves’). Importantly, in the US a cup is 240ml.**

To increase fiber intake, the US Dietary Guidelines recommend that the majority of fruit

intake be whole fruit (fresh, frozen, canned, or dried) rather than juice.

The scientific rationale for the 125ml serve of fruit juice deemed a “fruit serve” is not evident in the Australian Guide to Healthy Eating materials. The energy equivalence approach applied in the US may well prove valuable in deciding the fruit juice serve equivalent for a fruit serving in the revised version of the Australian Guide to Healthy Eating.

The high degree of nutritional similarity between whole fruit and fruit juice, considered in combination with the marked impact fruit juice makes to meeting fruit serve recommendations, support the current and future inclusion of fruit juice within the fruit serves advice and a possible reconsideration of equivalent serve size – as per the US model.

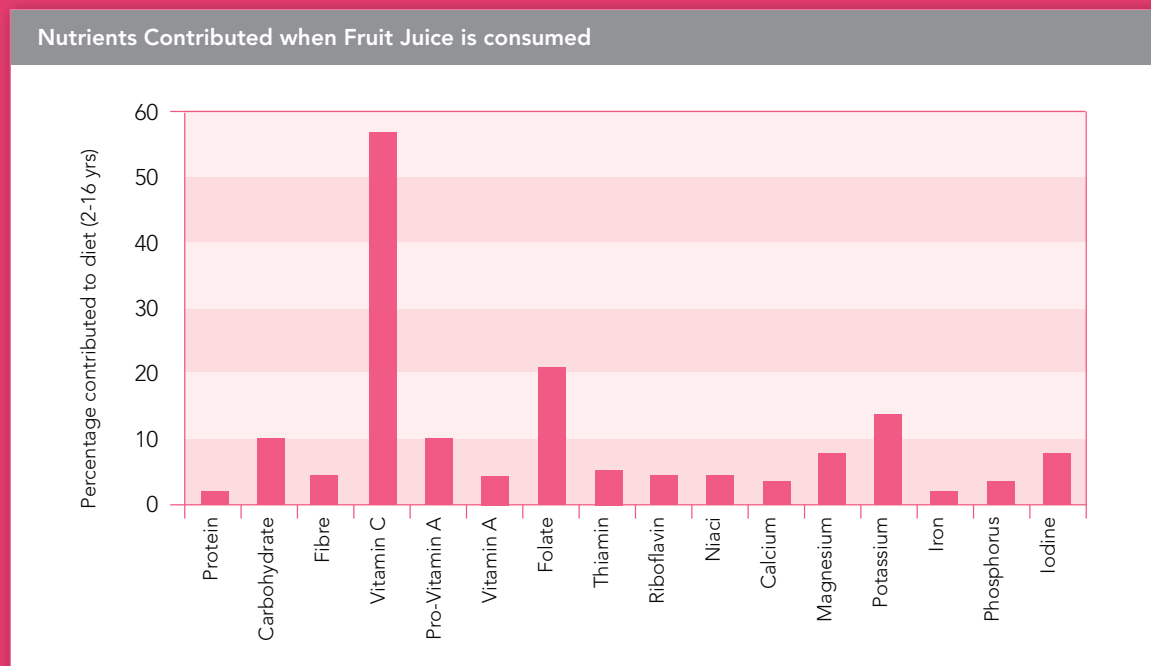
THE NUTRITIONAL CONTRIBUTION OF FRUIT JUICE

Fruit juices are acknowledged as containing a wide variety of nutrients<sup>4</sup> and the Flinders analysis reflects this.

Not surprisingly, fruit juice was a major contributor of Vitamin C providing 56% across all children 2-16

years. Taken together with whole fruit, the total contribution of Vitamin C was 73%.

Importantly fruit juice makes a significant contribution to some important nutrients including carbohydrate, folate and potassium as shown below:



A glass of fruit juice is a valuable source of fluid and provides Vitamin C, folate, potassium and range of other micronutrients as well as antioxidants such as anthocyanin, catechin, and phenols<sup>4</sup>. In addition, some juices are fortified and as such their nutritional contribution is even greater.

**Phytonutrients**

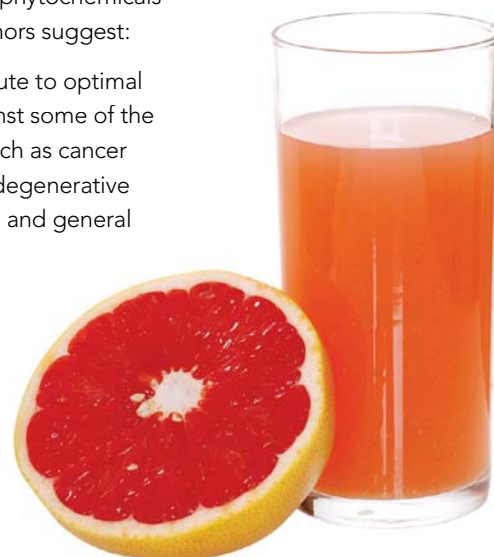
Phytonutrients have been associated with a range of benefits including reducing the risk of certain cancers as well as cardiovascular disease<sup>13-16</sup>.

An Australian study<sup>17</sup> showed:

“One orange has over 170 different phytochemicals, including more than 60 flavonoids many of which have been shown not only to have antioxidant effects but also... anti inflammatory and anti tumour activity...”

In considering the impact of phytochemicals in citrus fruits/juices, the authors suggest:

“...these substances contribute to optimal health and may protect against some of the common chronic diseases such as cancer and cardiovascular disease, degenerative eye and cognitive conditions and general damage caused by aging.”<sup>17</sup>



## KEY FINDING

### DIET QUALITY OF FRUIT JUICE CONSUMERS

A number of investigators have shown fruit juice consumers have better nutrient intakes relative to non-consumers and tend to have healthier overall dietary patterns<sup>18</sup>.

The Flinders analysis<sup>1</sup> also showed that those consuming juice had beneficial dietary features compared to those not consuming fruit juice.

When fruit juice was consumed, the diet was found to be...

**Significantly lower in total fat, saturated fat, protein and caffeine,**

And...

**Significantly higher in total folate, carbohydrates, vitamin C, provitamin A, dietary folate equivalents, energy, magnesium, total sugars and potassium.** (p<.01)



The Flinders analysis shows important dietary positives are associated with the consumption of fruit juice and as such, the overall impact of juice intake is generally positive. The higher total sugars observed differ from other similar studies that found lower added sugars in those consuming fruit juice<sup>19</sup>. In regard to the higher energy, this has been observed in previous studies and without further analysis cannot be attributed solely to juice<sup>19</sup>. Lower protein intakes should not be a concern.

The broadly positive impact of fruit juice on the dietary pattern of Australian children is consistent with other recent findings. A large US study<sup>19</sup> found that, compared to those children who did not consume fruit juice, those who consumed more than 170 ml

of fruit juice daily had significantly higher intakes of total carbohydrate, vitamins C and B6, folate, potassium, magnesium and iron.

Children consuming fruit juice also had significantly lower intakes of total and saturated fat as well as added sugar and more servings of fruit and vegetables compared to non-juice consumers<sup>19</sup>.

The association between fruit juice consumption and healthier lifestyle habits was also observed in a study of adults where juice consumers showed better weight control along with higher intakes of wholegrain breads, fruits, raw vegetables and a lower intake of high fat foods<sup>20</sup>.

### FRUIT JUICE, OBESITY AND METABOLIC SYNDROME – NHANES 1999-2004<sup>30</sup>

An analysis of a multiethnic sample of U.S. adults (n=14,196) from the National Health and Nutrition Examination Survey (NHANES) 1999-2004 examined the association between 100% fruit juice consumption and odds of obesity (body mass index (BMI) = 30 kg/m<sup>2</sup>) and metabolic syndrome.

The authors concluded; "...compared to non-consumers, 100% fruit juice consumers

were leaner, more insulin sensitive, and had lower odds of obesity and metabolic syndrome."

The association with obesity remained after controlling for confounding lifestyle factors, while the association with metabolic syndrome was primarily explained by lifestyle factors.

### FAST FACT: CALCIUM INTAKE

Despite the common belief that children consuming fruit juice may compromise calcium intake, by replacing milk with fruit juice, the 2007 Children's survey showed no significant difference between the calcium intakes of juice consumers relative to those not consuming juice<sup>1</sup>.



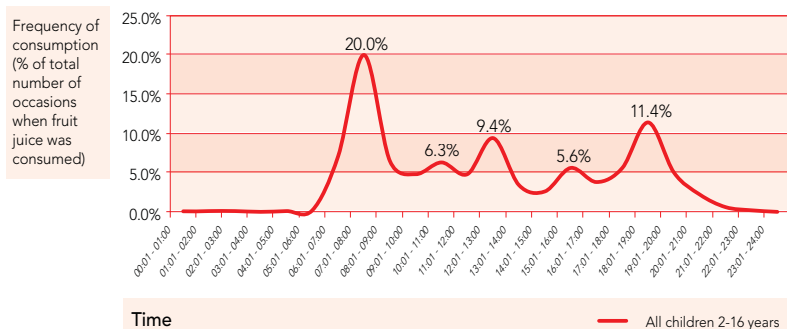
## WHEN IS FRUIT JUICE CONSUMED?

Fruit juice is often consumed with the breakfast meal and has been associated with a good quality breakfast<sup>21</sup>.

Perhaps not surprisingly, Australian children also prefer juice at the breakfast occasion as the following intake data reflects:

Most drinking occasions, 52.7% coincide with main meals and mid meal occasions with 20% of all drinking occasions occurring between 7 and 8 am.

Frequency of fruit juice consumption versus time (all children 2-16 years)



There appeared to be 3 distinct meal peaks (7-8am; 12-1pm; 6-7pm) and 2 distinct mid meal occasions (10-11am; 3-4pm).

### Time of Consumption and Dental Health

A practical recommendation given by dental health authorities<sup>22</sup> is that in order to maintain good oral health, food and beverage products containing sugars and/or acid should be consumed with meals as the saliva generated by eating helps protect the teeth.

It is a positive finding therefore that just over half of the fruit juice consumed by Australian children takes place with main meal and mid meal occasions

Such a pattern of intake (juice with meals) allows Australian children to take advantage of the health and nutritional benefits of fruit juice while minimising the risk of dental caries. Although on-going educational initiatives to encourage a greater concentration of usage at these times may further improve dental health outcomes.

**More than half (53%) of the fruit juice consumed by Australian children coincides with meals and mid meals.**

Additional practical drinking advice to help deliver better dental health outcomes includes:

- Do not hold or "swish" the drink around the mouth
- Use a straw to reduce exposure to the teeth
- Consume chilled drinks as this can reduce erosion<sup>23</sup>

Diluting juice for young children, avoiding sugar in bottles for infants and regular brushing with fluoridated toothpaste are all important messages to help prevent tooth decay<sup>24</sup>.

### Fruit Juice and Disease Risk Reduction

The protective effects of fruits and vegetables in regard to diseases such as cardiovascular disease (CVD) and cancers have been documented<sup>25,26</sup>. For example, it has been reported that the risk of coronary heart disease (CHD) is reduced by 4% for each additional serving of fruit and vegetable per day and by 7% for fruit intake<sup>27</sup>.

In 2007, the World Cancer Research Fund/ American Institute for Cancer Research expert report on diet and cancer concluded that vegetables and fruits may protect against a range of cancers including mouth, stomach and bowel cancer, leading the report to recommend that people should try to eat more<sup>28</sup>.

A recent review<sup>15</sup> of medline as well as Cochrane studies on the relationship between fruit juice and CVD (37 published studies) as well as fruit juice and cancer (11 published studies) revealed the data for fruit juice and cancer was inconclusive (although weakly positive). However in relation to fruit juices and CVD the authors concluded:





**“There was convincing evidence from epidemiological and clinical studies that pure fruit and vegetable juices reduced risk via a number of probable mechanisms.<sup>15”</sup>**

Indeed, the reviewers also stated:

**“When considering cancer and coronary heart disease prevention, there is no evidence that pure fruit and vegetable juices are less beneficial than whole fruit and vegetables.<sup>15”</sup>**

### Health Benefits of Specific Juices

Investigators around the globe have been active in exploring specific fruit juices and the health benefits they may provide. The research includes human, animal and in vitro studies that may in time form the basis for specific health claims for particular fruit juice products.

A small snapshot of recent studies (see below) highlight the exciting potential for fruit juice varieties to deliver important health benefits:

- Apple juice and atherosclerosis prevention (animal)<sup>31</sup>
- Apple juice and reducing cognitive decline (animal)<sup>32</sup>
- Citrus fruit juices and reduced ischemic stroke risk (human)<sup>33</sup>
- Cranberry juice and urinary tract infection – treatment (human review)<sup>34</sup>
- Grape juice and improved endothelial function (human)<sup>35</sup>
- Grape juice and reduced platelet aggregation (human)<sup>36,37</sup>
- Orange and blackcurrent juice and reduced inflammation markers (human)<sup>38</sup>
- Pomegranate juice and inhibition of prostate cancer growth (animal)<sup>39</sup>

### QUICK SURVEY FACTS

- 37% of all children consumed fruit juice on the day of the survey
- For 10% of children, fruit juice was the only fruit serve for the day
- When juice was consumed, the most popular amount was 200-300g (around a glass). This remains unchanged from 1995.
- Boys consistently consumed more fruit and fruit juice than girls
- Fruit juice consumers have lower sodium intake than non-consumers ( $p < .05$ )
- When consumed, fruit provided 23% of total sugars and fruit juice 19%.
- Fruit juice contributes no fat, saturated fat or salt to the diet of Australian children.

### FRUIT JUICE – IN SUMMARY

Australian children, on average, consumed around 122mls of fruit juice on the day of the survey, an intake considered to be consistent with a healthy diet. In addition, the weight of evidence does not support an association between fruit juice consumption and weight gain in children.

The 2007 Children’s survey also revealed that the percentage of total energy contributed by fruit juice has not changed since 1995 (2% of total energy) and that the diets of those children consuming fruit juice contained a number of nutritional positives (less fat and saturated fat, more folate, potassium and vitamin C) relative to those not consuming juice.

Fruit juice makes a marked contribution to helping Australian children achieve their fruit serve recommendations and as such, the retention of fruit juice in the fruit serving

advice of the revised Australian Guide to Healthy Eating is clearly warranted. As part of the guides review, diet modeling via an energy equivalence model, as per the US, could prove highly informative.

An important finding is that just over half the juice is consumed by Australian children with meals and mid meals. Dental health advice supports and encourages such a combination due to the protection this provides.

The literature also shows fruit (and vegetable) juices may actively reduce the risk of chronic diseases like cardiovascular disease and the potential for specific juice varieties to deliver health benefits is developing momentum.

As such, the scientific evidence clearly supports fruit juice within a healthy and varied diet that incorporates a physically active lifestyle.

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