**Are Australian parents following feeding guidelines that will reduce their child's risk of dental caries?**

**Short running title: Comparing feeding and beverage consumption in young children with guidelines**

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**Abstract**

**Background:** Early childhood is an important time to establish eating behaviours and taste preferences, and there is strong evidence of the association between the early introduction of sugar-sweetened beverages and obesity and dental caries (tooth decay). Dental caries early in life predicts lifetime caries experience and worldwide expenditure for dental caries is high.

**Methods:** Questionnaire data from the Splash! longitudinal birth cohort study of young children in Victoria, Australia was used to examine beverage consumption and parental feeding behaviours of young children, aiming to provide contemporary dietary data and assess consistency with the Australian dietary guidelines.

**Results:** From 12 months of age, the proportion of children drinking sugar-sweetened beverages consistently increased with age (e.g. fruit juice consumed by 21.8% at 12 months and 76.7% at four years of age). However, the most common beverages for young children are milk and water, consistent with Australian dietary guidelines. In relation to other risk factors for dental caries, at six months of age children were sharing utensils and at 12 months almost three quarters of carers tasted the child’s food before feeding.

**Conclusions:** The increasing consumption of sugar-sweetened beverages and prevalence of other risk factors for dental caries and obesity through early childhood continues to be a problem despite efforts to raise awareness of these issues with parents.

**Key words:** infant, children, feeding, dietary guidelines, sugar-sweetened beverages, dental caries

**Introduction**

Dental caries (tooth decay) is one of the most prevalent chronic diseases facing young children worldwide and is preventable (Anil et al., 2017; Gussy et al., 2006; Kassebaum et al., 2015). Children in less advantaged groups are more likely to experience poor oral health, caries and higher levels of dental disease (Gomes et al., 2018; Julihn et al., 2018; Locker, 2000; Mejia et al., 2012; Schwendicke et al., 2015)*.* The impact of dental caries is a major economic burden worldwide (Australian Institute of Health and Welfare, 2014; Public Health England, 2013).

Early childhood is an important time to establish healthy behaviours, with a clear association between the early introduction of sugar-sweetened beverages (SSBs) and development of obesity and dental caries (Gibbs et al., 2016; Malik et al., 2013; Ribeiro et al., 2017). The World Health Organization (WHO) Guidelines strongly recommend children and adults reduce the daily intake of free sugars to less than 5% of their total intake(World Health Organization, 2015). Free sugars refer to all monosaccharides and disaccharides added to foods by the manufacturer, cook or consumer, plus sugars naturally present in honey, syrups and fruit juices (World Health Organization, 2003). However a recent report has shown that children aged 2-3 years consume on average 32 grams of added sugars which equates to approximately 8% of their energy intake (Australian Institute of Health and Welfare, 2018).

Dental caries is caused by sugar being broken down in the mouth by the cariogenic bacteria (most notably Mutans Streptococci) to produce lactic acid (Gussy, 2006). Over time, lactic acid production leads to a breakdown of the enamel surface and development of dental caries (Gussy, 2006). The consumption of SSBs means more sugar is available in the mouth. Similarly, when a child takes a bottle containing milk to bed, milk pools around the teeth and, as there is less saliva flow at night, the milk remains in the mouth and the lactose is broken down to produce lactic acid. Other behaviours such as parents sampling foods before feeding their child and children sharing utensils also enable transmission of cariogenic bacteria to young children (Sakai et al., 2008; Fan et al., 2016).

Little research has examined beverage consumption and associated cariogenic-feeding behaviours in young children. The aimof this study isto examine patterns of beverage consumption in young children, and parental feeding behaviours, and examine consistency with current Australian infant feeding and dietary guidelines (National Health and Medical Research Council, 2012, 2013). The Australian guidelines have similarities to the WHO guidelines (World Health Organization, 2015) which are more prescriptive with reducing intake of sugar, particularly for children.

**Methods**

This paper uses data collected in Splash! (de Silva-Sanigorski et al., 2011), a longitudinal birth cohort study of children in the Barwon-South Western (BSW) region of Victoria, Australia. This region is considered socio-economically disadvantaged and had an estimated total population at the time of 350,109 (Australian Bureau of Statistics, 2012). The population is on average older, and more socio-economically disadvantaged compared to Victoria, Australia as a whole.

The Splash! Study involved recruitment of expectant mothers from antenatal and general practice clinic (see Splash protocol for more detail; (de Silva-Sanigorski, 2011). Inclusion criteria required the adult participant to be the primary carer of the child participant, living in the BSW region and English-speaking. Data was then collected at child ages of six, 12, 24, 36 and 48 months. The data were collected at each time point using paper-based questionnaires and included questions about dietary patterns, oral health behaviours and socio-demographic information. A food frequency questionnaire (FFQ) collected data on food and beverage intake of infants. The parent/carer answered questions about their own health, diet and physical activity, in addition to questions relating to their child’s health, development, feeding habits and oral health practices. Beverages in the FFQ comprised 17 specified drink items in the form of ‘Does this child drink any of the following?’ Participants could also add other beverages consumed. Additional questions about feeding practices related to the transmission of oral bacteria to the child, for example sharing cutlery. Proportions were calculated using Microsoft Excel and 95% confidence intervals were calculated using Wilson binomial confidence interval formulae.

At the time data were collected, the relevant guidelines used by health professionals were the Australian Dietary Guidelines (ADG) (National Health and Medical Research Council, 2013) and Infant Feeding Guidelines (IFG) (National Health and Medical Research Council, 2012) (see Appendix 1). We compared the reported behaviours of parents/carers and infant feeding practices related to oral bacteria transmission with these guidelines.

**Ethics**

The University of Melbourne Human Research Ethics Committee (0932148.6) and the Barwon Health Human Research Ethics Committee (09/84) approved the Splash! Study. Participants provided written consent prior to participating.

**Results**

**Demographics of the cohort**

Key demographic details of the Splash! cohort are summarized in Table 1. The sample was from a non-metropolitan area and was more likely to be representative of expectant mothers attending antenatal clinics and general practice clinics in the region at the time of recruitment than representative of the Victorian population of expectant mothers. On average, primary carers were aged about 30 years at baseline and approximately one third had a Health Care Card (an indicator of low income). Just under 50% of the children were male. At the start of the Splash! study, 458 dyads were recruited. There were 354 dyads at six months, 327 at 12 months, 317 at 24 months, 245 at 36 months and 150 at 48 months. Despite changes in participant sample over time, we believe that the sample remained representative.

**Beverage consumption**

Table 2 presents infant beverage consumption. The consumption of both breast milk and formula decreased by 12 months of age. Water was the most consumed beverage across all ages, followed by full-fat milk between 12 months and two years. By the age of 12 months, almost one quarter of infants were consuming fruit juice/fruit drink, and this consistently increased with age. At three years of age, fruit juice was the second highest consumed beverage and by four years of age, a higher proportion of infants consumed fruit juice than full fat cow’s milk. The proportion of children consuming other SSBs increased markedly from 12 months. At four years of age, three quarters of the cohort were drinking fruit juice, one third were drinking cordial (a sugar-based syrup diluted with water), and just over half were drinking carbonated (soft) drink. A small proportion of children were drinking non-dairy milk beverages such as soy and rice milk. From two years of age onwards, approximately a quarter of children were drinking flavoured or sweetened milks (e.g. milk with honey added).

**Parental and infant feeding behaviours**

Table 3 presents key feeding practices at each time point. At six months of age, almost 20% reported tasting milk, and just over 70% reported tasting food, before giving it to the child. By 12 months, both behaviours had slightly increased and peaked.

The use of a dummy/pacifier was more common at six months than for any other age group with more than half of children aged between six and twelve months using one. Many parents of these children indicated that they had cleaned their child’s dummy in their mouth before giving it to the child.

The most frequent time for parents to share utensils with their child was between 12 months and three years. This is consistent with the introduction of a greater variety of solid foods with the carer still involved in the feeding process. The IFG and child oral health resources recommend that parents and carers do not taste food with the same utensil used to feed their child, to avoid the vertical transmission of *Mutans Streptococci* (National Health and Medical Research Council, 2012*)*.

At six months of age, children were already beginning to share utensils with other children, and at two years of age, two thirds of children were sharing spoons, forks or cups with parents and almost half were sharing with other children. These behaviours increase the risk of horizontal transmission of salivary bacteria.

**Bottle feeding practices**

The results (Table 3) show that, just under 20% of children at age 12 months had fallen asleep with a bottle in their mouth, and almost a third of children at two years of age were going to bed with a bottle. At six and 12 months of age children taking a bottle to bed were mostly having baby formula in the bottle (Table 4). At two and four years of age, the most common contents was cow’s milk (non-breast milk and non-formula) and at three years of age those who took a bottle to bed most commonly had water in the bottle.

**Comparison of beverage consumption and behaviours with key guideline documents**

Table 5 summarizes comparisons between guidance from the ADG and IFG about actual beverage consumption by infants and children in this study (more detailed information about the guidelines is in Appendix 1). These recommend breast milk or formula and water before 12 months of age, with the addition of cow’s milk from 12 months and limitation of SSBs.

Whilst the IFG recommend exclusive breastfeeding until six months of age, and continuation through to 12 months, more than half of the infants at age 6 months in this cohort received formula and about half received breast milk. Apart from water, full-fat cow’s milk was the most commonly consumed beverage between 12 months and two years of age, which is consistent with the guideline recommending full-fat milk consumption over low-fat milk for children under the age of two years. Despite the recommendation for breast milk and cow’s milk-based formulas to be the primary beverage up to age 12 months, some children were already consuming cow’s milk: almost 6% of six months old were consuming full fat milk and nearly 3% consuming low fat milk.. Sixty five percent of infants at 12 months were consuming full-fat milk compared with less than 6% at 6 months; another 5% of 12 month olds were drinking low fat cow’s milk; these data suggest that a high proportion of infants at 12 months were consuming cow’s milk earlier than recommended. Our data show that it was not uncommon for mixed feeding to occur even from a very young age. Use of toddler formula was not captured or assessed within this study.

After 12 months of age, the proportion of infants who were consuming full-fat milk continued to increase, at the same time as the proportion who consumed breast milk and formula decreased. This is also consistent with the ADG recommendation for children under two years who are no longer breastfeeding to consume full-fat milk. The ADG recommend ‘mostly reduced fat’ dairy products to be consumed after the second year of life. A large proportion of study children were still consuming full fat cow’s milk past two years of age, and a large proportion drinking SSBs. Flavoured or sweetened milk (e.g. milk with honey added) was consumed increasingly over time, which is against the ADG recommendations and may contribute to an increase in sugar consumption and become a replacement or preference for unflavoured milk.

**Discussion**

This study examined patterns of beverage consumption and parental feeding behaviours in young children in a large cohort study and compared these behaviours with Australian dietary guidelines. The results showed some consistency with the guidelines, although a number of inconsistent behaviours were prevalent, including carers tasting children’s food, children sharing utensils with other children, and children consuming SSBs. This supports results from another international study that has shown non-compliance with dietary guidelines in terms of children’s consumption of foods and drinks (Banfield et al., 2016).

**Beverage consumption**

Milk and water were commonly consumed in early childhood, broadly consistent with recommendations. Mixed feeding was not uncommon even from a very young age. Other studies have also shown a decline in breastfeeding with rates as low as 15% to 12 months reported despite high rates of initiation of breastfeeding (Esbati et al., 2017). Low rates of breastfeeding have also been identified in the US where only half of women are breastfeeding their infants at six months and only one third of women in UK are breastfeeding at this time point (Victora et al., 2016). The 2010 Australian National Infant Feeding Survey reported approximately 60% of infants were receiving some breast milk at six months (Australian Institute of Health and Welfare, 2011). Our study also showed that mixed feeding was not uncommon, even from an early age. The consumption of non-recommended beverages in this study rose rapidly across early childhood, which is similar to findings from another study (Amezdroz et al., 2015).

**SSB consumption**

SSB consumption is associated with higher rates of dental caries (Wilder et al., 2016). Although a recent paper has highlighted the difficulty in identifying sugar intake in the UK due to under-reporting (Evans, 2017). Parents show a general understanding that high volume or frequent consumption of SSBs increases a child’s risk of dental caries (Armfield et al., 2013; Evans et al., 2013; Lin et al., 2017). However, our results suggest that ADG recommendations to “avoid” and “limit” these beverages are not reducing their introduction in early childhood (Pawellek et al., 2017; van de Gaar et al., 2017). A recent study found young children who had SSBs available at home were up to five times as likely to be high consumers (Hebden et al., 2013), suggesting that it is important to change family member behaviours as well as the young child’s behaviours.

The importance of the WHO guidelines on reducing sugar intake and the opportunity for policy makers has been highlighted (Breda et al., 2018) and a recent European position paper has also identified mechanisms for reducing sugar consumption in young children (Fidler Mis et al., 2017). In Australia, Food Standards Australia New Zealand (FSANZ) require packaged foods marketed to infants (up to age two years) to be labelled as “sweetened” if they contain more than four grams of added sugar. However, this is not required for food or drink for children older than two years. Whilst knowledge about the impact of SSBs on health may be available, guidelines do not provide adequate real-life examples of how to incorporate consumption of SSBs into individual lifestyles nor do they affect external social factors such as what is available and to whom it is marketed. For example, a 200 ml glass of SSB contains approximately 19 grams of sugar which equates to approximately 5% of 4 year olds recommended total energy intake (based on 6000 kJ intake). As any form of added sugar contributes to both dental caries and obesity, there is a need to review education and social policies about foods and SSBs that are marketed to children. Parents have identified that the marketing of SSBs is a key factor influencing child drink choice and consumption (Hennessy et al., 2015; Johnson et al., 2016).

Although the ADG and IFG offer nutritional evidence to inform and support healthy lifestyles, it appears that other approaches may also be required including clear, distinct and unique behaviour change models for individuals and populations (Boak et al., 2016; Hoare et al., 2014).

**Transmission of oral bacteria**

That saliva transfer behaviour of giving children food or bottles that have been in contact with the carer’s mouth occurred frequently during early stages of infancy is concerning as early exposure to large numbers of *Mutans streptococci* is linked with a higher risk of developing dental caries, when combined with high sugar (Fan et al., 2016; Finlayson et al., 2017; Saraithong et al., 2015).

Sharing foods and utensils between children may also be a high-risk behaviour as children who have already been exposed to the bacteria associated with dental caries can transmit to those who have not been previously exposed (Domejean et al., 2010). Clear guidelines need to target parental education before the introduction of solid foods, and the associated risks of oral bacteria transmission from unsafe feeding practices needs to be emphasised. Our past research (de Silva-Sanigorski et al., 2013) and research by others (Sakai et al., 2008) has shown low levels of understanding of the transmission issue by carers of young children; there is a need to ensure that this message is mainstream in dental and general health information for parents..

**Bottle feeding practices**Using bottles after the age of twelve months is not recommended for developmental reasons as well as a child’s risk of developing ECC when they fall asleep with a bottle, containing milk, baby formula, or SSB. However, our study showed that this practice was occurring. Strategies are needed to increase parental awareness to either stop bottle use after their child is aged over 12 months, or only allow water within the bottle.

**Infant Feeding Guidelines (IFG)**The current IFG recommendation is to limit fruit drinks or SSBs only in the first twelve months of life with no further guidance past twelve months. Specific recommendations are necessary to avoid ambiguity and to encourage reduced consumption of fruit juice. Some terms such as “family foods consistent with the *Australian Dietary Guidelines* to be introduced post-12 months” may be confusing.

**Australian Dietary Guidelines (ADG)**

Based on the food modelling system used in the ADG, children aged two to three years are encouraged to consume a minimum of one serve of fruit per day- accompanying these recommendations is the standard serve size for fruits and vegetables, which includes 125ml of 100% fruit juice equivalent to one serve of fruit. However, the inclusion of fruit juice here is inconsistent with the recommendation for young children to avoid fruit juices. This may confuse parents into perceiving that fruit juice is part of a healthy diet, particularly when marketed in that way. If SSBs must be consumed, guidelines could indicate that consuming at mealtimes is preferable, to limit the number of acidic challenges to teeth (Tahmassebi et al., 2006).

**Strengths and Limitations**

This study provides important information about parental feeding behaviours and beverage consumption in young children within a large cohort study. Comparing these with existing guidelines identified areas of consistency and discrepancy. It is a study limitation that quantities of each beverage consumed or milk used in cooking were not captured and we did not capture reasons for not breastfeeding. We also note that there was attrition of participants at the 4 year time point; however, our assessment showed that the sample remained representative at this time point.

**Recommendations for health professionals and educators:**

1. Improve clarity of guidelines by removing ambiguous or contradictory statements, and providing practical messages.
2. Ensure that the message of not sharing food utensils with infants is clear and available in mainstream dental and general health information for parents.
3. Emphasize the importance of why infants and children should not go to sleep with the feeding bottle in the mouth.
4. Encourage parents and carers to provide fruit rather than juice, as processing fruit into juice increases its decay-causing potential and removes important fibre content.

**Key Messages**

* The most common beverages for young children were milk and water.
* Consumption of SSBs and full-fat milk by children in this cohort was inconsistent with the Australian Dietary Guidelines.
* Consumption of SSBs began early and was frequent by two years of age.
* Despite guidelines recommending children do not take bottles to bed, and parents not to share feeding utensils to taste their child’s food, these practices were commonly occurring.

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**Table 1:** Splash! cohort characteristics

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | **6 months** **(n=354)** | **12 months** **(n=327)** | **24 months****(n=317)**  | **36 months****(n=245)**  | **48 months** **(n=150)** |
| Child’s mean age (months) | 6.9 ± 1.6 (n=335) | 12 ± 1.9 (n=291) | 25 ± 2.0 (n=275) | 37 ± 2.4 (n=217) | 49 ± 2.5 (n=134) |
| Proportion of children who are male | 46% | 47% | 46% | 44% | 49% |
| Parent’s mean age | 30.8 ± 5.3 (n=352) | 31.4 ± 5.4 (n=323) | 32.9 ± 5.3 (n=315) | 34.4 ± 5.0 (n=242) | 35.3 ± 4.8 (n=150) |
| Proportion of parents with a healthcare card | 29% | 28% | 30% | 24% | 29% |

\* Some age data was missing for the children in the cohort (the n within the table reflect the number of participants who provided age data)

**Table 2:** Proportion of children reported to have consumed beverages at the various Splash! time points

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Beverage** | **6 months (n=354)****% (95% CI)** | **12 months (n=327)****% (95% CI)** | **24 months (n=317)****% (95% CI)** | **36 months (n=245)****% (95% CI)** | **48 months (n=150)****% (95% CI)** |
| **Breast Milk** | 55.8% (55.9, 61.2) | 34.3% (29.3, 39.9) | 5.4% (3.2, 8.5) | 1.2% (0.3, 3.5) | 0% |
| **Formula** | 62.4% (57.2, 67.5) | 47.1% (41.5, 52.7) | 8.0% (5.5, 11.9) | 2.4% (0.9, 5.3) | 0% |
| **Cow’s Milk**Full FatLow Fat | 5.7% (3.5, 8.6)2.5% (1.2, 4.8) | 64.8% (59.2, 69.8)5.2% (3.1, 8.3) | 79.3% (74.4, 83.6)14.3% (10.7, 18.7) | 67.8% (61.5, 73.4)24.5% (19.2, 30.4) | 64.0% (55.8, 71.7)26.7% (19.8, 34.5) |
| **Milk alternatives**Soy milkRice milkSweetened condensed milkSweetened or flavoured milk | 1.1% (0.3, 2.9)1.4% (0.5, 3.3)0.8% (0.2, 2.5)0.8% (0.2, 2.5) | 2.8% (1.3, 5.2)0.3% (0.01, 1.7)0.3%(0.01, 1.7)3.7% (1.9, 3.4) | 4.8% (2.7, 7.8)2.5% (1.1, 5.0)0%26.1% (21.3, 31.3) | 6.1% (3.5, 9.9)2.9% (1.2, 5.8)0%27.8% (22.2, 33.8) | 6.7% (3.2, 11.9)1.3% (.016, 4.7)0%30.7% (23.4, 38.7) |
| **Fruit Juice or fruit drink**  | 8.5% (5.8, 11.8) | 21.8% (17.5, 26.7) | 58.9% (53.3, 64.4) | 72.7% (66.6, 78.1) | 76.7% (69.1, 83.2) |
| **Sweetened Beverages**CordialDiet cordial Soft drink Diet soft drinkSweetened waterSports drinks | 1.4% (0.5, 3.3)1.4% (0.5, 3.3)0.6% (0.07, 2.3)0.8% (0.2, 2.5)0.8% (0.2, 2.5)0.6% (0.1, 2.0) | 8.0% (5.0, 11.2)0.6% (0.01, 2.2)3.4% (1.7, 6.0)0.3% (0.01, 1.7)0%0% | 25.8% (21.1, 31.0)3.2% (1.5, 5.8)18.2% (14.1, 22.9)3.5% (1.8, 6.2)0.3% (0.01, 1.8)0.3% (0.01, 1.8) | 33.9% (28.0, 40.2)3.3% (1.4, 6.3)28.2% (22.6, 34.2)6.5% (3.8, 10.4)0.4% (0.1, 2.3)0% | 34.7% (27.1, 42.9)4.7% (1.9, 9.4)42.7% (34.5, 51.0)10.0% (5.7, 16.0)0.7% (0.02, 3.7)1.3% (0.2, 4.7) |
| Plain water | 72.5% (67.5, 77.1) | 99.1% (97.3, 99.8) | 97.1% (94.6, 98.7) | 98.4% (95.9, 99.6) | 100% (97.6, 100) |
| **Other**Herbal drinksTea/coffee | 1.1% (0.3, 2.9)0.6% (0.07, 2.3) | 1.8% (0.7, 4.0)0.9% (0.2, 2.7) | 3.2% (1.5, 5.8)2.2% (0.9, 4.5) | 2.4% (0.9, 5.3)3.7% (1.7, 6.9) | 4.7% (1.9, 9.4)4.7% (1.9, 9.4) |

\*Small numbers of parents/carers did not provide data at the time points. Missing data was between 0.6 and 0.9%

The beverage consumptions are not mutually exclusive (i.e. the child may have been consuming more than one beverage at any time point).

**Table 3:** Feeding behaviours at the time points across the study

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | **6 months****n=354****% (95% CI)** | **12 months****n=327****% (95% CI)** | **24 months****n=317****% (95% CI)** | **36 months****n= 245****% (95% CI)** | **48 months****n=150****% (95% CI)** |
| I taste the milk in the bottle before feeding it to my child | 18.4%(14.4, 23.0)[n=337] | 24.1%(19.4, 29.2)[n=312] | 18.1%(13.9, 22.9)[n=304] | 8.0%(4.8, 12.4)[n=224] | 0% |
| I taste the food on the spoon before feeding it to my child | 70.8%(65.8, 75.5)[n=353] | 76.3%(71.2, 80.9)[n=316] | 53.0%(47.2, 58.5)[n=312] | 36.8%(30.4, 43.4)[n=226] | 26.7%(19.8, 34.5)[n=150] |
| My child uses a dummy or pacifier | 56.5%(51.3, 61.8)[n=354] | 46.4%(40.8, 52.0)[n=317] | 36.3%(30.1, 41.9)[n=309] | 17.0%(12.0, 23.1)[n=227] | 0% |
| I suck my child’s dummy or pacifier to clean it | 41.2%(35.0, 47.7)[n=245] | 42.1%(34.7, 49.7)[n=176] | 29.7%(22.2, 38.1)[n=138] | 2.3%(0.3, 8.2)[n=86] | 0% |
| I share spoons, forks or cups with my child | 35.3%(30.3, 40.6)[n=351] | 63.5%(57.9, 68.8)[n=315] | 65.6%(60.0, 70.9)[n=311] | 63.9%(57.3, 70.1)[n=227] | 54.0%(45.7, 62.2)[n=150] |
| My child shares spoons forks or cups with other children | 15.5%(11.9, 19.8)[n=348] | 34.6%(29.3, 40.2)[n=312] | 44.6%(29.1, 50.4)[n=311] | 42.9%(36.3, 49.6)[n=224] | 39.9%(32.1, 48.3)[n=150] |
| My child *usually* goes to bed with a bottle | 0% | 0% | 30.8%(22.1, 40.6)[n=104] | 5.0%(2.6, 8.5)[n=241] | 4.0%(1.5, 8.5)[n=149] |
| My child falls asleep with bottle in mouth | 0% | 19.6%(15.3, 24.4)[n=317] | 10.9%(7.6, 15.0)[n=303] | 6.6%(3.5, 10.7)[n=227] | 0% |

Numbers in [square brackets] refer to number of participants who provided data for each question (i.e. answered that question)

The variables in this table are not mutually exclusive.

**Table 4:** For those infants and children who took a bottle to bed, the content within the bottle

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **What is usually in the bottle when taken to bed?** | **6 months** | **12 months** | **24 months** | **36 months** | **48 months** |
|
| **n** | **% (95% CI)** | **n** | **% (95% CI)** | **n** | **% (95% CI)** | **n** | **% (95% CI)** | **n** | **% (95% CI)** |
|
|
| Water | 2 | 3.7% (3.2, 4.8) | 3 | 5.2% (1.1, 14.4) | 9 | 11.7% (5.5, 21.0) | 18 | 39.1% (25.1, 54.6) | 1 | 12.5% (0.3, 5.7) |
| Breast milk | 3 | 5.6% (1.2, 15.4) | 2 | 3.4% (0.4, 11.9) | 1 | 1.3% (0.03, 7.2)  | 0 | 0.0% | 0 | 0.0% |
| Infant formula | 43 | 79.6% (66.5, 89.4) | 26 | 44.8% (31.7, 58.5) | 4 | 5.2% (1.4, 12.8) | 2 | 4.3% (0.5, 14.8) | 0 | 0.0% |
| Other milk | 2 | 3.7% (0.5, 12.8) | 23 | 39.7% (27.1, 53.4) | 54 | 70.1% (58.6, 80.0) | 14 | 30.4% (17.7, 45.8) | 7 | 87.5% (47.4, 99.7) |
| Cordial | 0 | 0% | 0 | 0.0% | 1 | 1.3% (0.03, 7.2) | 1 | 2.2% (0.1, 11.5)  | 0 | 0.0% |
| Other | 4 | 7.4% (2.1, 17.9) | 4 | 6.9% (1.9, 16.7) | 8 | 10.4% (4.6, 19.5) | 11 | 23.9% (12.6, 38.8) | 0 | 0.0% |

**Table 5:** Comparison between guidelines and practices reported in this cohort

|  |  |  |
| --- | --- | --- |
|  | **Guidelines** | **Practice** |
| **Beverage** |
| Breast milk | Recommendation that exclusively breast feed until 6 months with breast feeding continuing to 12 months alongside introduction of solid foods | Approximately half of the infants received breast milk at 6 months, decreasing to a third at 12 months. |
| Formula | If an infant is not breastfed, formula should be used until 12 months of age. Other milk should not be introduced unless under medical supervision. | Small proportion (3-7%) of children were receiving soy milk, rice milk at 6 and 12 months. Cow’s milk was being fed to a small number of children at 6 months and this increased to over 60% of the cohort by 12 months. |
| Low fat milk and full fat milk | Should not be introduced until 12 months of age. Low fat milk should not be introduced until after 24 months of age. After 24 months of age, children should be drinking low-fat milk. | A large proportion of children aged 24 months and older were consuming full-fat milk. Low fat milk was consumed by less children. |
| Milk alternatives | Inappropriate as an alternative to cow’s milk in first two years of life. | Small proportion (3-7%) of infants were consuming non-cow’s milk by age 2 years. |
| Fruit juice | Recommended to avoid fruit juice in childhood and provide fruit instead. | High proportion (59-77%) of children were consuming juice, particularly at 24 months of age onwards. |
| Sweetened beverages | Avoid these and do not offer to young children. | Approximately a quarter of children were consuming these by age 24 months and this continued to increase over time. |
| Water | Recommended drink of choice for children (along with milk) | Most children (>75%) were consuming water at each age group. |
| Coffee, tea, herbal drinks | Do not offer to children | A very small number of children were consuming these (0.5%-4.7%). |
| **Feeding behaviours** |
| Tasting foods/milk | Do not taste food or milk prior to feeding child. | Many children consumed food or milk tasted previously by the carer. |
| Sharing utensils | Do not share utensils with others | Many children (16-45%) across the age groups were sharing utensils with carers and other children. |
| Bottles to bed | Put infant to bed without a bottle or take the bottle away when feeding is complete. Only water should be in the bottle. | Approximately 20% of infants and children fell asleep with a bottle at 12 month time point. Of these, many had liquids other than water. |

**Appendix 1:** Guidelines for infant feeding

|  |  |  |
| --- | --- | --- |
| **Beverage** | **Infant Feeding Guidelines: Information for health workers (IFG)**  | **Australian Dietary Guidelines (ADG)**  |
| **Breast Milk** | * It is recommended that breastfeeding occurs exclusively up until 6 months of age.
* Any breastfeeding is beneficial to the mother and the infant.
* Breastfeeding is recommended to be continued until 12 months of age alongside introduction of solid foods.
 | * Infants should be exclusively breastfed until around six months of age when solid foods are introduced.
* Any milk given to infants (as a drink) should be breast milk or infant formula.
* The energy content of breast milk varies between 270 and 315 kJ/100ml.
* Being breastfed is associated with reduced risk of overweight/obesity in later life.
* Breast milk provides all the vitamins, major minerals and trace elements known to be essential for healthy full-term infants for around the first 6 months of life. These nutrients are more bioavailable than those found in formulas.
 |
| **Formula** | * If an infant is not breastfed, or only partially breastfed, commercial infant formulas should be used as an alternative to breast milk until 12 months of age.
* Cow’s milk-based formulas up until 12 months of age should be consumed by infants not receiving breast milk (unless advised by a medical professional otherwise).
* Soy or goats milk-based formulas are not suitable alternatives for infants with allergies to cow’s milk-based formulas unless used under medical supervision.
* Bottle feeding according to need is appropriate- recommendations on formula packages are a guide only.
* Infant formulas should be used as an alternative to breast milk until 12 months of age if a child is not/partially breastfed.
 | * Care should be taken in the preparation of formula, including sterilisation of bottles and equipment.
* When an infant is not breastfed, or is partially breastfed, commercial infant formulas should be used as an alternative to breast milk until 12 months of age.
* All formulas available in Australia are regulated by the Australia New Zealand Food Standards Code and contain adequate nutrients for infants.
 |
| **Cow’s milk**Full-fatLow -fat | * Any unmodified milk from non-humans is not suitable for infants and should not be given as the main drink before 12 months of age
* Cow’s milk products (full fat yoghurt, cheese, custard) may be given at 6 months of age.
* Pasteurised full cream milk may be introduced to a child’s diet as a drink around 12 months of age and be continued throughout the second year of life and beyond; do not use unpasteurised cow’s/goat’s milk.
* Low-fat and reduced fat milks are not recommended in the first two years of life.
* After 12 months of age the consumption of cow’s milk should be limited to around 500 mL because of the high protein and low iron content and the risk of reducing diversity in the diet.
 | * Cow’s milk as a drink should not be given to infants under 12 months of age.
* Any milk given to infants (as a drink) should be breast milk or infant formula.
* Cow’s milk may be served in small quantities as custards, with cereals or as yoghurt.
* For children less than two years old reduced fat cow’s milk is not recommended due to high energy needs and growth.
* **Milk** and water are the recommended drinks for children.
* Guideline 2.5: Enjoy milk, yoghurt, cheese and/or alternatives, **mostly reduced fat**.
* It is recommended that boys and girls aged 24-36 months of age consume a minimum of one and a half serves of milk, yoghurt, cheese and/or their alternatives, mostly reduced fat.
* At 4 years of age it is recommended that boys consume two serves a day and girls maintain one and a half serves.
 |
| **Milk alternatives**Soy milkRice milkSweetened condensed milkSweetened or flavoured milk | * Special complementary foods or milks for toddlers are not required for healthy children.
* Soy (except fortified soy products and soy formula where specifically indicated) and other nutritionally incomplete milk substitutes are inappropriate alternatives to breast milk, formula or whole cow’s milk in the first two years of life.
 | * **Soy** (except soy follow-on formula) and other nutritionally incomplete plant-based drinks such as **rice,** oat, coconut or almond drinks are inappropriate alternatives to breast milk or formula in the first 12 months.
* Sweetened flavoured milk provides nutrients from milk but is high in kJ and is less preferable than plain milk.
 |
| **Fruit Juice or fruit drink** | * Fruit juice has no nutritional benefits over whole fruit for infants older than six months and children, and should be avoided
* 100% fruit juice or reconstituted juice can be a healthy part of the diet when consumed as part of a well-balanced diet
* Excessive juice consumption may be associated with malnutrition and with a variety of gastrointestinal symptoms.
* Consumption of fruit juice is not necessary or recommended and may interfere with the intake of nutrient-dense foods and fluids and increase the risk of damaging emerging teeth.
* Juice should not be introduced into the diet of infants before 6 months of age
* Infants should not be given juice from bottles or easily transportable covered cups that allow them to consume juice easily throughout the day
* Infants should not be given juice at bedtime
* Children should be encouraged to eat whole fruits to meet their recommended daily fruit intake
* Fruit juice limited to 120–180 mL per day for children aged over 12 months.
 | * Infants do not need added sugars and FSANZ stipulates that ready-prepared infant foods with more than 4g of added sugars per 100g must be labelled as ‘sweetened’.
* High or frequent consumption of added sugars, particularly for infants and young children, is associated with increased risk of dental caries.
* The dietary guidelines recommend all Australians **limit** intake of foods and drinks containing added sugars.
* Whole fruit is preferable to fruit juice due to its higher fibre content.
* Children and adolescents should limit intake of SSBs.
 |
| **Sweetened Beverages**CordialDiet cordial Soft drink Diet soft drink | * Avoid juices and sugar sweetened drinks.
* Do not offer **soft drinks, cordials** or other beverages.
 | * Infants do not need added sugars and FSANZ stipulates that ready-prepared infant foods with more than 4g of added sugars per 100g must be labelled as ‘sweetened’
* High or frequent consumption of added sugars, particularly for infants and young children, is associated with increased risk of dental caries.
* The dietary guidelines recommend all Australians **limit** intake of foods and drinks containing added sugars.
* Children and adolescents should limit intake of sugar-sweetened drinks
 |
| **Water** | * Boiled and cooled tap water for infants who are not exclusively breastfed between birth and 6 months is preferred.
 | * Breast milk supplies adequate
* water up to around 6 months of age, but cooled boiled water may need to be provided for formula-fed infants
* Milk and **water** are the recommended drinks for children.
 |
| **Other**Herbal drinksTea/coffee | * Do not offer tea, herbal teas, coffee, soft drinks, cordials or other beverages.
 |  |
| **Feeding practices** | * Milk and other drinks should be offered in a cup rather than a feeding bottle, after 12 months of age.
* Put an infant to bed without a bottle or take the bottle away when the infant has finished feeding or before they fall asleep; don’t let the infant keep sucking on the bottle.
* Avoid leaving an infant unattended with a bottle containing liquids (i.e. no bottle propping)
* Do not dip pacifiers or bottle teats in sugar, jam, honey or any other sugary substance.
* Avoid juices and sugar-sweetened drinks and foods and drinks with added sugars.
* Don’t put anything in an infant’s mouth if it has been in someone else’s mouth to avoid spreading bacteria that cause dental caries.
 |  |

**Additional information from the Nutrient Reference Values (NRV):**

1. Estimated Energy Requirements (EER):

Infants:

Boys- 2,700 kJ/day (7.9kg)

Girls- 2,500 kJ/day (7.2kg)

Higher total energy expenditure has been shown to be higher in formula fed infants than those breastfed

2. Infants exclusively fed breast milk do not require supplemental water

AI: Adequate Intake

0-6 months:0.7 L/day (breast milk or formula)