

THE UPPER LEVEL FOR FLUORIDE FOR CHILDREN AGED 1-8 YEARS

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Background

FSANZ estimated dietary intakes of fluoride for children as part of a recent Application to permit the addition of fluoride to bottled water. Although fluoridated tap water is widely available in Australia, and some bottled spring water contains some fluoride naturally, it is not currently permitted to sell bottled water with added fluoride.

As part of the risk assessment, the estimated dietary intakes were compared to the Upper Level (UL) of intake from the 2006 Nutrient Reference Values¹.

The **Upper Level of Intake** is the highest average daily nutrient intake likely to pose no adverse health effects to almost all individuals in the general population.

Methods for estimating dietary intake of fluoride

- Conducted using FSANZ's dietary modelling computer program (DIAMOND).
- 1995 Australian National Nutrition Survey consumption data.
- Recent food composition data for fluoride.
- Assumed drinking water contained fluoride at recommended range for reticulated water (0.6-1.0 mg/L).
- No intake from dental products included (e.g. toothpaste).
- Adjusted for within person variability to estimate the usual intake distribution.

Dietary intake Results

Figure 1 shows estimated mean and 95th percentile dietary intakes of fluoride for two age groups of children where the lower and upper end of the range of the recommended fluoridation level in reticulated water was assessed.

The estimated intakes are around or higher than the Adequate Intake (AI)¹ for fluoride for these age groups (AI = 0.7 mg/day for 1-3 years and 1.0 mg/day for 4-8 years).

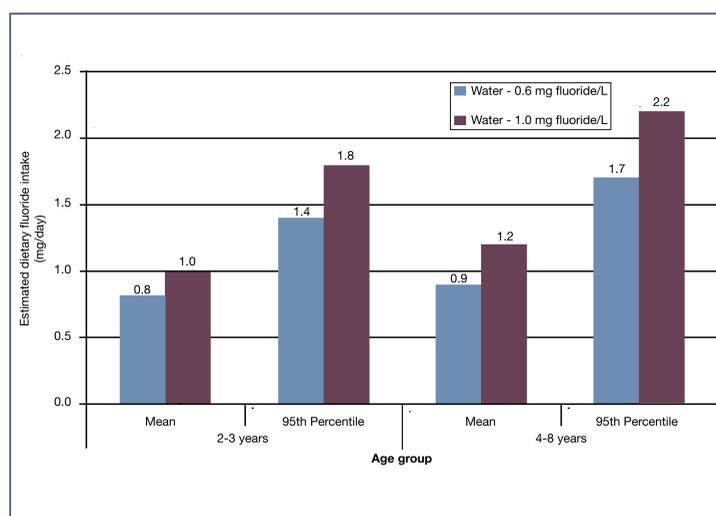


Figure 1. Estimated mean and 95th percentile dietary intakes of fluoride for Australian children aged 2 to 8 years

The unexpectedly high proportion of children exceeding the UL for their age group (Table 1) prompted investigation into the origin of the UL.

Table 1. Estimated proportion of Australian children who exceeded their Upper Level (UL)

Age Group	UL (mg/day)	Water Fluoride Level (mg/L)	% Exceeding UL
2-3 years	1.3	0.6	5
		1.0	22
4-8 years	2.2	0.6	<1
		1.0	5

Investigation of the derivation of the ULs for children

The Australian UL values were adopted without change in 2006 from the 1997 United States and Canadian ULs², which were based on a zero prevalence of moderate dental fluorosis for children aged <8 years.

Very mild and mild fluorosis – Not considered to adversely affect the function of the tooth, and may strengthen it.
Moderate and severe fluorosis – Staining, wearing and pitting of teeth. Described as an aesthetic adverse effect.

The ULs were based on dietary intakes of fluoride that were not associated with moderate dental fluorosis at the community level.

- Dean (1942)³ observed a zero prevalence of moderate dental fluorosis in US communities when reticulated water contained 1 mg/L of fluoride.
- It was assumed in these US communities that the amount of fluoride consumed via the diet was such that moderate dental fluorosis did not occur. Neither water consumption nor fluoride intakes were estimated by Dean³.
- Using a 1940's model diet⁴ fluoride intakes were estimated using the water fluoride level of 1 mg/L and the fluoride content of foods. Four different levels of water consumption, one amount of food and four different concentrations of fluoride in food were used.
- The upper value of the range of estimated intakes (0.1 mg/kg bw) was then used to determine the ULs by applying the more recent body weights of American children. This resulted in the ULs of 1.3 mg/day for 1-3 year olds and 2.2 mg/day for 4-8 year olds.
- However, recent US food and water consumption data were not used when setting the ULs.

Evaluation

- The range of fluoride intakes for Australian children was wider and positively skewed compared with those from US model diets (Figure 2).
- The estimated 99th centile of fluoride intake was 0.15 mg/kg bw/day for 2-3 year old Australians and 0.13 mg/kg bw/day for 4-8 year olds. This is above the current ULs.
- Despite this, the available dental evidence indicates that moderate and severe dental fluorosis is rare in Australian children⁵ even though the majority of them consume water with about 1 mg/L fluoride and have additional intakes of fluoride from dental products.

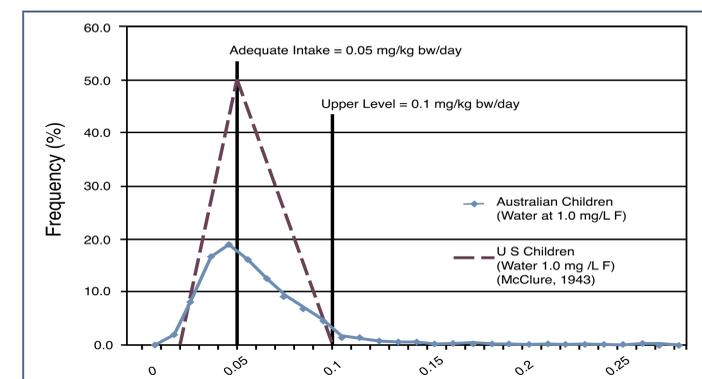


Figure 2. Comparison of the McClure (1943) data used to establish the current ULs for fluoride and dietary intakes for fluoride for Australian children as estimated by FSANZ.

Conclusions

- The current UL values for fluoride for children aged 1 to 8 years could be too low because moderate dental fluorosis is rare at current dietary fluoride intakes in Australia.
- The estimated exceedance of the ULs for Australian children is not a cause for concern.
- The estimated dietary intakes of fluoride for the US population in 1943 used to establish the ULs may not have allowed for the full range of fluoride intakes.

Future Directions

- Dietary intakes of fluoride for Australian children as estimated by FSANZ using national nutrition survey data could be used to assist in determining more appropriate ULs for this age group.
- These analyses should be re-done using the 2007 children's nutrition survey data to determine whether there have been important changes in water consumption over the previous 12 years prior to reconfirming or establishing new ULs for children.
- Studies linking fluoride intake data to dental appearance in young children would be useful.

Further Details

For further details see the Final Assessment Report for Application A588⁵ at www.foodstandards.gov.au/standardsdevelopment/applications.

References

1. National Health Medical Research Council and New Zealand Ministry of Health (2006) Nutrient Reference Values for Australia and New Zealand. Including Recommended Dietary Intakes. Fluoride p175-180. Commonwealth of Australia.
2. Food and Nutrition Board:Institute of Medicine (1997) Dietary Reference Intakes for Calcium, Phosphorus, Magnesium, Vitamin D and Fluoride. Washington DC, USA, National Academy press, Chapter 8, p288-313.
3. Dean, H.T. (1942) The Investigation of Physiological Effects by the Epidemiological Method. In Moulton F.R. ed. Fluorine and Dental Health. Am. Assoc. Adv. Sci., p23-31.
4. McClure, F.J. (1943) Ingestion of Fluoride and Dental Cries. Quantitative relations based on food and water requirements of children one to twelve years old. Am. J. Dis. Child. 66:362-369.
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