Summary
Campaigning groups have expressed concern that levels of fluoride in fluoridated water and those naturally present in tea may pose dangers to human health. However, expert bodies and independent reviews \(^1\)\(^2\) of the available scientific evidence have not demonstrated any positive link between enhanced levels of fluoride in the diet and an increase in cancer mortality. Chronic exposure to high levels of fluoride can lead to skeletal fluorosis.

A UKTC review of the data has shown that there is no reason for people who consume normal quantities of tea to be concerned about the fluoride content, or to change their tea drinking habits.

Detail
Fluoridated Drinking Water
Fluoride is not essential to human health but it has a role in bone mineralisation as it forms calcium fluoroapatite in teeth and bone and can protect against dental caries \(^3\)\(^4\).

Due to fluoride’s role in the prevention of dental caries, some water supplies are fluoridated to a level of 1 mg/l\(^3\). Fluoridation of public water supplies has always provoked a level of debate about its effectiveness and the potential for health risks. The primary focus of the risk argument remains enhanced rates of bone cancer, with dental and skeletal fluorosis being secondary concerns. The International Agency for Research on Cancer, a body of the World Health Organisation, has twice critically reviewed all the scientific studies on the subject in 1982 and 1987\(^1\)\(^2\). The Agency’s conclusion was that “none of the studies provide any evidence that an increased level of fluoride in water was associated with an increase in cancer mortality”. Furthermore, a study from the Food and Drug Administration’s National Centre for Toxicological Research \(^5\) stated that bone cancer risk was unrelated to water fluoridation. Additionally the US Centre for Disease Control Public Health Service Report \(^6\) noted that the National Cancer Institute identified no trends in cancer that could be attributed to the introduction of fluoride into drinking water.

Fluoride in tea
The tea plant naturally accumulates fluoride from the soil and the Food Standards Agency’s 1997 Total Diet Study \(^7\) found that in the UK the estimated average population exposure for fluoride is 1.2mg/day, this value being broadly in line with the 1.8 mg/day found in 1978-80. The study also showed that fluoride intake is heavily influenced by tea consumption with beverages accounting for 1mg/day, or 85% of the total fluoride intake, excluding any contribution from fluoride in the water used to make the tea. When the water is from a fluoridated supply this approximately doubles the fluoride intake for consumers drinking 4 to 5 cups of tea per day.
These values are in line with those found in earlier studies, which showed that the average fluoride content for tea made with fluoridated water is 2.2mg/litre. Consequently a litre of tea (4 to 5 cups) prepared with fluoridated water will provide a daily fluoride intake of 2.2mg or 0.03mg/kg body weight (for a 70 kg adult). Also to note, EFSA set an upper limit with reference to fluoride in 2006, which is 0.12 mg/kg body weight per day. This is equivalent to an Upper Level of 5mg a day in children aged 9-14 years and 7 mg a day for those people 15 years and older, including pregnant and lactating women.

**Fluorosis**

Dental fluorosis is caused by chronic ingestion of high levels of fluoride when teeth are being formed, i.e. in young children, with the risk becoming negligible by the age of eight. Dental fluorosis is typically seen as whitish patches on affected teeth and is associated with a daily fluoride intake of 0.1mg/kg body weight. It does not impact on the health of the teeth and, indeed, reduces the susceptibility of the enamel to dental decay. The only concern is a deleterious cosmetic effect in severe cases.

Typical tea consumption for younger children is 0 to 2.5 cups per day. This results in a fluoride intake of 0.04mg/kg, i.e. well below the level of concern, particularly when most of the tea drunk by this age group is heavily diluted with milk and so actually contains a lower level of fluoride.

Skeletal fluorosis is caused by chronic exposure to very high levels of fluoride. The US Institute of Medicine reported that: “most epidemiological research has indicated that an intake of at least 10mg per day for 10 or more years is needed to produce clinical signs of the milder forms of the condition”. The Institute of Medicine further noted that skeletal fluorosis was not seen in the US where water supplies contained up to 20mg/l fluoride. Therefore tea, at 2.2mg/l, would not be expected to cause a problem.

**Safety Assessment of tea consumption**

Analyses of leaf tea and instant tea powders show that the fluoride levels in tea leaves and tea powder lie in the range of 100 - 500 mg/kg, although values for instant tea powders can be significantly higher (up to 2300 mg/kg). However, when the ready-to-drink versions of these products are tested, the fluoride levels are very low for ice tea products (< 1 mg/kg) and low to medium for instant tea products (0.5 - 3.6 mg/kg).

Scientific publications on the safety of fluoride tend to provide data in the form of maximum tolerable daily intakes, Daily Recommended Intakes (DRI), or Upper Limits (UL).

In the US, the National Academy of Sciences (NAS) fixed the maximum tolerable intake of fluoride for adults (including children from 9 years upwards, and pregnant and lactating women) at 10mg/day, which is consistent with the view of the US Institute of Medicine as referred to above. The Daily Recommended Intake as set by NAS is 4-5 mg/day.

In Europe, the European Food Safety Authority’s opinion paper on fluoride states that the Tolerable Upper Intake Level for Fluoride has been agreed at 0.12 mg/kg body weight/day, which for an average European adult is equivalent to 7 mg/day.

If it is assumed that the average fluoride content for tea made with fluoridated water is 2.2mg/l then it can be assumed that at the highest 95th percentile consumption of tea, a level of 3.3mg fluoride could be consumed each day significantly below the figure set by EFSA.
On the basis of samples tested, normal tea consumption leads to a maximum intake of 3.3 mg of fluoride per day, which is far below the maximum tolerable intake limits described above. Therefore, normal tea drinking within a wide spectrum of intake does not represent a public health concern in relation to fluorosis. Accordingly, there is no reason for people who consume normal quantities of tea to change their tea drinking habits.

References
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