

# Fluoride

Atomic number 9  
Atomic weight 18.99

## Collection

Serum/Plasma	2 mL	Plastic container No anticoagulant / Heparin
Urine	20 mL	Sterile Universal

## Reference ranges

			Reference
Serum/plasma	µmol/L	0.3-1.5	1
Blood			
Urine	µmol/L		
	µmol/24 h	< 86	
	mol/mol creatinine	5	2

## Notes

The therapeutic range for fluoride in osteoporotic patients is 5-10 µmol/L fluoride (100-200 µg/L). Unwanted effects may occur at levels above 15 µmol/L fluoride (300 µg/L).

## References

1. Husdan H, Rudolph Yogi R, Oreopoulos D, Gryfe C, Rapoport A. Serum Ionic Fluoride: Normal Range and Relationship to Age and Sex. Clin Chem. 1976; 2: 184-188
2. Guidance on laboratory techniques in occupational medicine, 12<sup>th</sup> Edition 2013, Health and Safety Laboratory.

## Clinical

The amount of fluoride in the body appears not to be regulated, so that concentrations found in plasma depend on the amount ingested, on the rate of excretion and on bone turnover rate. The first varies with locality and whether fluoride has been added to the drinking water for the purpose of reducing tooth decay. The kidneys are the principal route of excretion and thus plasma concentrations are higher in patients with renal failure. Fluoride in plasma is present as organically bound and ionic forms; it increases proportionally with the concentration in drinking water. The physiological properties of fluoride depend on the ionic activity and its tendency to form highly insoluble calcium fluoride. Drinking water fluoridation is a controversial topic. Many studies have confirmed that fluoride prevents dental caries and that addition to the water supply is the simplest way of providing this protection. The addition of fluoride to toothpaste is also effective and a combined preventative approach has been recommended as being most effective. However, there is concern over both the toxicity of fluoride and the principle of compulsory treatment of whole populations *versus* freedom of choice.

## Toxicity

Acute exposure to hydrogen fluoride or fluorine by inhalation, or through the skin, leads to severe persistent burning and severe systemic toxicity with dramatic reductions in serum calcium and magnesium concentrations. Acute exposure to excess fluoride causes nausea and diarrhoea. Chronic exposure to sodium fluoride by ingestion leads to osteofluorosis with sclerosis of bones and ligaments. The ability of fluoride to promote the calcification of bone has led to its use in the treatment of patients with severe osteoporosis and crush fractures, who cannot be treated by other means. The dose of fluoride is intended to stimulate osteoblast activity without causing sclerosis. In patients with possible

renal impairment, serum fluoride should be monitored regularly during sodium fluoride therapy.

### **Laboratory indices of fluoride status**

Fluoride concentrations can conveniently be measured in either serum or urine.

Prevention of osteofluorosis in workers who are occupationally exposed to fluoride is best conducted by monitoring random urine samples. Pre-shift urine samples collected after 1-2 days away from the workplace reflect the body burden of fluoride, while post-shift sample concentrations are used to monitor the exposure.

### **References**

1. Ehrnebo M, Ekstrand J. Occupational fluoride exposure and plasma fluoride levels in man. *Int Arch Occup Environ Health* 1986; **58**: 179-90
2. Augenstein WL, Spoerke DG, Kulig KW, Hall AH, Hall PK, Riggs BS, El Saadi M, Rumack BH. Fluoride ingestion in children: A review of 87 cases. *Pediatrics* 1991; **88**: 907-12
3. Bader JD, Shugars DA, Rozier G, Lohr KN, Bonito AJ, Nelson JP, et al. Diagnosis and management of dental caries. Evidence report. Research Triangle Institute, University of North Carolina at Chapel Hill, Evidence-Based Practice Center. 2000.
4. O'Mullane D, Clarkson J. Choosing Appropriate Preventive Approaches. [www.lib.umich.edu/dentlib/nihcdc/abstracts/omullane.html](http://www.lib.umich.edu/dentlib/nihcdc/abstracts/omullane.html)