

# Barium

Atomic number 56  
Atomic weight 137.34

## Collection

Serum/Plasma 10 mL Plastic tube - plain, EDTA or heparin  
Use Trace Elements Certified tubes  
*NB – particularly avoid gel-containing tubes. These may contain significant amounts of Ba*

Urine 20 mL Sterile Universal

## Reference ranges BARIUM

			Reference
Serum/plasma			
Blood		1.2-8.7	1
Urine	nmol/L	2.9-37	2,3,4
	nmol/24 h	3.3-95.9	3,5
	nmol/mmol creatinine	Less than 8	3,5,6

## References

- 1 Heitland P, Köster HD. Biomonitoring of 37 trace elements in blood samples from inhabitants of northern Germany by ICP-MS. *J Trace Elem Med Biol* 2006; 20(4): 253-62.
- 2 Heitland P, Köster H. Fast, simple and reliable routine determination of 23 elements in urine by ICP-MS. *J. Anal. At. Spectrom.* 2004, 19, 1552–1558
- 3 Trace Elements at the London (Ontario) Laboratory Services Group:  
<http://www.lhsc.on.ca/lab/metals/index.htm>
- 4 NHANES CDC (2009) Fourth National Report on Human Exposure to Environmental Chemicals, Department of Health and Human Services Centers for Disease Control and Prevention: [http://www.cdc.gov/exposurereport/pdf/FourthReport\\_UpdatedTables\\_Sept2012.pdf](http://www.cdc.gov/exposurereport/pdf/FourthReport_UpdatedTables_Sept2012.pdf)
- 5 Sieniawska CE, Jung LC, Olufadi R, Walker V, Twenty-four hour urinary trace element excretion: reference intervals and interpretive issues. *Ann Clin Biochem* 2012; 49: 341-51.
- 6 Morton J, Leese E, Tan E, Cocker J. Determination of 61 elements in urine samples collected from a non-occupationally exposed UK adult population, *Toxicol. Letters* 2014; 231: 179-193.

## Clinical

Barium is an alkaline earth metal, principally found as barite (barium sulfate) and witherite (barium carbonate) ores.

Barium compounds are widely used in industry as getters in electronic tubes (barium alloys), high-temperature superconductors and electro-ceramics. It is a colorant in paints, glass, tiles, ceramics, and fireworks. The insoluble sulphate is used medically as an inert radio-opaque, gastro-intestinal contrast medium. Barium carbonate is a rodenticide while barium sulphide is in depilatories.

Absorbed barium rapidly disappears from the blood with most entering bone. Much smaller amounts are found in muscle, adipose, skin, and connective tissue. Excretion is via the faeces with lesser amounts in the urine.

Currently, no essential role for barium is known.

## Toxicity

While exposure may be via inhalation, oral, or dermal routes; under most circumstances oral exposure predominates. Many barium salts are insoluble and relatively harmless if ingested. However, the water soluble carbonate and chloride are highly poisonous.

Case reports of individuals intentionally or accidentally ingesting high doses of barium provide accounts of acute toxicity. Symptoms include abdominal pain, vomiting and diarrhoea, numbness around the face, muscle weakness, paralysis. The main biochemical effect is hypokalaemia which follows from the action of barium as a potassium channel blocker inhibiting efflux from intracellular compartments. The consequences are ECG abnormalities, ventricular tachycardia, hypertension and/or hypotension, muscle weakness, and paralysis. There are some reports of renal damage in case reports of individuals ingesting high doses of barium and in animal studies.

In occupational settings a benign pneumoconiosis (baritosis) may occur from the inhalation of dust from crushing barium containing ores, and in welders.

## Laboratory Investigations

Barium has historically been a difficult metal to measure in biological specimens, other than in situations of serious acute toxicity. Increased availability of analysis by inductively-coupled plasma mass spectrometry will remedy this. Measurements may be in blood, plasma/serum or urine. However, there are no data correlating barium levels in these samples with specific exposure levels.

In cases of suspected serious acute poisoning, serum or plasma measurement is the most appropriate approach. Occupational exposure can be monitored by urine analysis, but interpretation of results may be problematic.

In cases of suspected colovesical fistula, urine may contain substantial amounts of insoluble barium sulphate following use of this compound as a diagnostic contrast medium.

In the United States NHANES surveys the geometric mean concentrations of barium in the urine are approximately 1.5 µg/L. A median urinary concentration of 1146 ng/L (range 295–5,250 ng/L) was reported in urine of 50 healthy individuals, aged 20–68 years, in central Italy

## References

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