# Barium

**November 2013**

## Introduction

Barium has no defined biological role and, while many barium salts are insoluble and relatively harmless if ingested, there is no safe level for this element in body tissues and fluids. The water soluble carbonate and chloride salts are highly poisonous, but nevertheless barium sulphate is regularly administered to humans as the "barium meal" for radiographic visualization of the gastro-intestinal tract. Barium chloride has been used therapeutically in the past as a stimulant for the heart, while barium sulphide (BaS) was formerly used as a depilatory agent [1,2].

It has been suggested that barium plays a role in the choroid of the eyeball and is essential for vision, but this has not been confirmed [3].

## Effects of barium on synaptic transmission and catecholamine release

Barium can replace calcium in many physiological processes, giving it a potent effect on nerve and muscle activity. Barium can mimic the action of calcium in the release of neurotransmitters, evoking the release of acetylcholine from the neuromuscular junction, noradrenaline from the sympathetic nerve terminals and catecholamines from the adrenal medulla. The barium-evoked release of these substances is persistent, while release by calcium is transitory and terminated by membrane repolarization. This action results in the potent muscular and cardiac toxicity of barium [3].

## Toxicity

The absorption of barium from the gastrointestinal tract is largely dependent on the solubility of the barium salt and the age of the subject. Less than 10% of ingested barium is believed to be absorbed in adults, but absorption may be significantly higher in children. Absorbed barium enters the blood and various tissues before being sequestered into the bone.

Adverse health effects have been observed in sensitive individuals (e.g. renal patients) following exposure to barium as a medical X-ray preparation medium. Symptoms of acute poisoning include abdominal pain, vomiting, diarrhoea and cardiac distress. Loss of deep reflexes with the onset of muscular paralysis may then ensue [4].

## Environmental exposure to barium

Barium compounds are used:

- in paints (permanent white or "blanc fixe" is $BaSO_4$) including car paints,
- in X-ray diagnostic work and for body imaging (the "barium meal" is also the sulphate, which is insoluble),
- in glass-making,
- in the manufacture of rubber,
- as a rat poison (the carbonate).



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Barium compounds are added to fireworks to impart a green color. Barium is used in the manufacture of a wide variety of electronic components, in metal alloys, bleaches, dyes, ceramics and glass. Barium oxide is used to coat the electrodes of fluorescent lamps to improve electron release. Un-monitored drinking water may contain excess barium, particularly where there is a run-off from mining operations. Subjects drinking such water over a period of years may experience an increase in their blood pressure.

## Specimen requirements

Blood for barium analysis should be collected into a trace element-free (dark blue top) BDH venoject tube. For urine determinations a sample from a 24-hour or 6-hour urine collection should be submitted.

## Methodology

Barium determinations are carried out by inductively coupled plasma-mass spectrometry (ICPMS).

## Interpretation of results

Urine barium levels should be less than 7.7 μmol per mole of creatinine and blood levels below 20 nmol/L

### References


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